2016-2017
Annual Assessment Report Template

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

Please begin by selecting your program name in the drop down. If the program name is not listed, please enter it below:

BA Mathematics

OR

Question 1: Program Learning Outcomes

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

- [ ] 1. **Critical Thinking**
- [ ] 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, Competency, and Perspectives**
- [ ] 13. Ethical Reasoning
- [ ] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. **Global Learning and Perspectives**
- [ ] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [x] 18. **Overall Disciplinary Knowledge**
- [ ] 19. **Professionalism**
- [ ] 20. 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 including how your specific PLOs are **explicitly** linked to the Sac State **BLGs**/**GLGs**:

The Department of Mathematics and Statistics considers one of its goals to be the pursuit of an excellent instructional program that provides our students with the requisite knowledge and skills to allow them to fulfill their potential in their chosen professional lives. All majors should achieve mastery of basic mathematical ideas and techniques ranging across the following fields – Single and Multivariate Calculus, Algebra, Analysis, Differential Equations, and Mathematical Modelling. At the heart of mathematics is the ability to read, interpret, and produce mathematical proofs. All majors should achieve an understanding of the nature of proof.

These goals intersect with a broad range of Sac State's BLGs including competence in the discipline, analysis and problem solving, communication, and information competence.

Analysis and Problem Solving: through their major courseowrk, students are encouraged to analyze complex mathematical problems, test solutions and mathematics-based arguments, identify and solve quantitative problems. Within the curriculum, students may be encouraged to work individually or in groups.

Communication: communicating complex mathematical ideas is essential to the discipline. Students are exposed to multimodal formats essential to expressing mathematical ideas: graphical, text, and symbolic. In the Capstone course, students are required to make oral presentations. Students involved in the PAL sections gain valuable experience working with peers who may not have the same level of mathematical sophistication.

Information Competence: students enrolled in technology-based courses (e.g. Math 150, Math 170, and Stat 196J/128) are expected to use computer applications including an advanced word processor (MS Word with the Equation Editor or a markup language such as LaTeX) and a programming language. As technology becomes more ubiquitous, other courses are also adopting these tools (e.g. Math 121 - College Geometry). Faculty have taken advantage of the flexibility of SacCT to share additional resources and communicate with their students.

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", see http://degreeprofile.org) 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 **OR** type in **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 Disciplinary Knowledge

If your PLO is **not listed, please enter it here**:

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

As suggested on the recommendations from last year's Annual Assessment, the department consulted with the Office of Academic Program Assessment to work on strategies for implementing the program assessment plan. Among the suggestions were to provide an explanation of how our learning outcomes align with campus BLGs and to consider how to directly measure student learning. During consultation, it was also suggested that achieving some of these goals is difficult with the working Assessment Plan. To address the suggestions, it was felt that a reasonable first step would be to begin to update the Assessment Plan. In addition to adding more descriptive language about the learning goals and assessment tools, changes included:

1. Incorporated curricular guidelines from national organizations (Mathematical Association of America, Society for Industrial and Applied Mathematics, and the American Statistical Association).

2. Developed rubrics for two of the Learning Goals.

3. Added a section on the Student Experience.

4. Added a Curriculum Map.

This project will continue throughtout the year. As indicated on the document, this is still a draft that more discussion within the department.

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.

See Assessment Plan.

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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 (key assignments, projects, portfolios, course work, student tests, etc.) 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 **provide** the direct measure (key assignments, projects, portfolios, course work, student tests, etc.) you used to collect data, THEN **explain** how it assesses the PLO:

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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 in **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.

Since your last assessment report, **how have the assessment data from then been used** so far?	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:

Q5.3. To what extent did you apply **last year's feedback** from the Office of Academic Program Assessment in the following areas?	1. Very Much	2. Quite a bit	3. Some	4. Not at All	5. N/A
1. Program Learning Outcomes	○	○	○	○	○
2. Standards of Performance	○	○	○	○	○
3. Measures	○	○	○	○	○
4. Rubrics	○	○	○	○	○
5. Alignment	○	○	○	○	○
6. Data Collection	○	○	○	○	○
7. Data Analysis and Presentation	○	○	○	○	○
8. Use of Assessment Data	○	○	○	○	○
9. Other, please specify:	○	○	○	○	○

Q5.3.1.
Please share with us an example of how you applied **last year's feedback** from the Office of Academic Program Assessment in any of the areas 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:

No file attached No file attached

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

- [ ] 1. **Critical Thinking**
- [ ] 2. **Information Literacy**
- [x] 3. **Written Communication**
- [x] 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, Competency, and Perspectives**
- [ ] 13. Ethical Reasoning
- [ ] 14. Foundations and Skills for Lifelong Learning
- [ ] 15. **Global Learning and Perspectives**
- [ ] 16. Integrative and Applied Learning
- [ ] 17. Overall Competencies for GE Knowledge
- [ ] 18. **Overall Disciplinary Knowledge**
- [ ] 19. **Professionalism**
- [ ] 20. 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**)

Program:

(If you typed your program name at the beginning, please skip to Q10)

Q9.
Program/Concentration Name: [skip if program name appears above]
BA Mathematics

Q10.
Report Author(s):
David Zeigler

Q10.1.
Department Chair/Program Director:
David Zeigler

Q10.2.
Assessment Coordinator:
David Zeigler

Q11.
Department/Division/Program of Academic Unit
Mathematics & Statistics

Q12.
College:
College of Natural Science & Mathematics

Q13.
Total enrollment for Academic Unit during assessment semester (see Departmental Fact Book):
4484

Q14.
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:

Q15. Number of **undergraduate degree programs** the academic unit has?
1

Q15.1. List all the names:

Mathematics

Q15.2. How many concentrations appear on the diploma for this undergraduate program?

0

Q16. Number of **master's degree programs** the academic unit has?

1

Q16.1. List all the names:

Mathematics

Q16.2. How many concentrations appear on the diploma for this master's program?

0

Q17. Number of **credential programs** the academic unit has?

0

Q17.1. List all the names:

Q18. Number of **doctorate degree programs** the academic unit has?

0

Q18.1. List all the names:

When was your **assessment plan**...	1. Before 2011-12	2. 2012-13	3. 2013-14	4. 2014-15	5. 2015-16	6. 2016-17	7. No Plan	8. Don't know
Q19. developed?	◉	○	○	○	○	○	○	○
Q19.1. last updated?	○	○	○	○	○	◉	○	○

Q19.2. (REQUIRED)
Please **obtain** and **attach** your latest **assessment plan**:

Math Assessment Plan 2017.pdf
148.93 KB

Q20.
Has your program developed a **curriculum map?**

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

Q20.1.
Please **obtain** and **attach** your latest **curriculum map**:

No file attached

Q21.
Has your program indicated in the curriculum map where assessment **of student learning** occurs?

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

Q22.
Does your program have a capstone class?

- ◉ 1. Yes, indicate: Math 193
- ○ 2. No
- ○ 3. Don't know

Q22.1.
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 2017

Departmental Assessment Plan

Department of Mathematics and Statistics

June 30, 2017

Introduction

The Department of Mathematics and Statistics at California State University, Sacramento is committed to developing and implementing a comprehensive assessment plan that is tied to the department's mission and can be used to guide decision making, maintaining accountability, and foster understanding. With its priority focus on the students, the department provides an environment in which teaching, scholarship, research and creative activity are valued and supported. We aim to continuously improve programs and processes through introspective assessment and evaluation.

1 Mission Statement

The Department of Mathematics and Statistics perceives its mission to be the pursuit of an excellent instructional 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, 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, government, 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.

2 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 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. Students will understand and use the definitions and basic properties of fundamental concepts in algebra and analysis, such as group, ring, function, derivative, and integral.

2. **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. As part of the exposure to the methods of proof and the subseuent mastery of proof writing:

   (a) Students should be familiar with common notations and proof techniques.

   (b) Students should be able to read, understand, and reconstruct rigorous proofs of elementary theorems in various areas of mathematics.

   (c) Students will be able to write elementary proofs.

Application of these fundamental mathematical methods leads to a deeper insight into the nature of the subject.

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 should be able to explain their solutions and proofs both orally and in writing. 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 an ability to use technology to solve mathematical problems.**

   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-based tools in MATH 121 (*College Geometry*), MATH 150 (*Introduction to Numerical Analysis*), MATH 170 (*Linear Programming*), STAT 115 (*Introduction to Probability and Statistics*), and STAT 128 (*Statistical Computing*). MATH 190 (*History of Mathematics*) also utilizes technology through the use of mathematical typesetting software such as LaTeX. In lower division courses, technology is also used in the classroom to assist with visualization of mathematical structures. Students should be able to effectively use technology to convey mathematical information or perform complex mathematical calculations.

All Math majors should learn how to use mathematical and statistical software, programming and other technologies. Since a large number of mathematics majors end up as mathematics teachers, it is important for students to be exposed to the uses of technology in teaching in a variety of classes. The best students in addition to having a variety of technology skills at their disposal would also have the ability to understand which of these skills are most likely to succeed or not succeed in solving a specific problem they are faced with.

3 Achieving Learning Goals

1. **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 Functions of a Real Variable (MATH 130). All math majors are required to study these courses.

2. **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 (*Functions of a Real Variable*). Students are also exposed to the methods of proof in a variety of classes including MATH 35 (*Introduction to Linear Algebra*), MATH 101 (*Combinatorics*), MATH 102 (*Number*

Theory), and MATH 121 (*College Geometry*).

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 Advanced Mathematics for Science and Engineering (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 an ability to use technology to solve mathematical problems.**

   All math majors are required to take a course in Computer Science. In Statistics (STAT 115,

STAT 196J/128) 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.

The curriculum map below summarizes the information above. Each column corresponds to each Learning Goals item and each row corresponds to a course.

Curriculum Map : Learning Goals $\times$ Matrix of Courses

	1	**2a**	**2b**	**2c**	**3**	**4**	**5**
MATH 30	I	I			I	I	
MATH 31	R				R	R	
MATH 32	R,A				R	R	
MATH 35	I	I	I		I	I	
MATH 45	R	R			R	R	
MATH 101	I	R	R		R	R	I
MATH 102	I	R	R		R	R	I
MATH 105AB	R	R			R	R	I
MATH 108	R	I	I	I	I	I,R	
MATH 110AB	I,A	R	R	A	R	R	
MATH 117	A	R	R	R	R	R	
MATH 121	R,A	R	R	R	R	R	I
MATH 130AB	R,A	R	R	R	R	R	
MATH 134	R,A	R	R	R	R	R	
MATH 150	R				R	R	I
MATH 161	A	R	R	R	R	R	

MATH 162	A	R	R	R	R	R	
MATH 170	R				R	R	I
MATH 190	R	R	R		R	R	I
MATH 193	R	R	A	R	R	A	
STAT 115AB	R				R	R	
STAT 196J / 128	R				R	R	I

Table 1: I=Introduced, R=Reinforced, A=Advanced

4 Assessment Plan

A variety of tools will be used to gather performance indicators and determine if student learning outcomes have been achieved. Please note that not all assessment tools are appropriate for the entire program. For example, comprehensive exams are exclusively used within the graduate program. 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. All students should be able to read short articles and book chapters at an undergraduate level and write reports or give oral presentations to explain the material to their fellow classmates and the instructor. All students should be able to explain their solutions/proofs to simple applied and theoretical problems to their fellow students and the instructor. The best students should also be able to explain and motivate their independent/advanced work to classmates and professors. 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 (*Functions of a Real Variable*) 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.

   The survey would be to asks graduates about their current academic or employment status. The purpose of the survey would be to gauge the image of the department and measure the effectiveness of the program to prepare students for their future endeavors in education, government, or industry.

   The alumni surveys are meant to elicit the opinions of students after they have worked in industry or an academic environment for a number of years. The interval provides the

student with the time to determine the worth of their degree from the viewpoint of a working professional or advanced graduate student. This type of survey will provide information that is impossible to gather using exit surveys. Points addressed will include the value of the degree in the job search or application to a graduate program, student preparation for industry or academic work, and strengths and weaknesses of the major.

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.

   The exit interview are meant to ilicit the student's opinion on a number of points including the effectiveness of the instruction, the applicability of coursework, future career goals, preparation for career and further academic work, and the strengths and weaknesses of the major program. They may be used to determine if a student feels that their own personal learning outcomes have been achieved, and to identfiy elements of the degree program or its operation that may need reconsideration.

   We started regular exit interviews of graduating students in 2016. The success of this practice has encouraged us to continue this practice. However, as the size of our program growsm it has become increasingly difficult to schedule interviews. We are considering an electronic survey that students can complete before graduation.

6. **Placement Assessment**: To evaluate or confirm the effectiveness or necessity of recent curriculum changes, the percent of students passing various Mathematics or Statistics courses will be compated against their ALEKS PPL placement assessment score.

Beginning in 2017, the department uses a new placement assessment system based on ALEKS Placement, Preparation and Learning (ALEKS PPL). The ALEKS PPL system is intended to replace the Intermediate Algebra Diagnostic (IAD) and Calculus Readiness (CR) tests that have been used since 1980. A web-based system, the Placement Assessment is designed to determine what students know and what students need to improve. At the end of the Placement Assessment, students will have a better sense of their strengths and weaknesses. Unlike the IAD/CR, students will be allowed to retake the assessments after reviewing the topics. ALEKS PPL scores will help support the discussion of using multiple measures for appropriate placement.

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.

Assessment of Learning Goals

Learning Goal 1: 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 2: 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 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 an ability to use technology to solve mathematical problems.

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

5 Alignment

In general, the BA Mathematics program 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. The Applied Mathematics and Statistics emphases are designed to provide more opportunites to meet Goal 5. As technology becomes more ubiquitous, the curriculum in classes associated with the Pure and Teacher Preparatory emphases are seeing more software-based tools playing a larger role. The Math department might want to consider adding additional upper division courses where students are expected to write projects and give oral presentations to give students more chances to enhance their communication skills (Goal 4). 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 5). The Math curriculum is also aligned with curriculum guidelines published by national organizations like the Mathematical Association of America (MAA). [1] Presently the Math Department is developed but not highly developed in this area. The Applied Math emphasis may consider following the curriculum guidelines published by national organizations like Society for Industrial and Applied Mathematics (SIAM). [2] The Statistics emphasis borrows guidelines published by national organizations like American Statistical Association (AmStat). [3]

[1] http://www.maa.org/sites/default/files/CUPM_brochure_2015%20%281%29.pdf
[2] http://www.siam.org/about/mii/Report.pdf
[3] https://www.amstat.org/asa/education/Curriculum-Guidelines-for-Undergraduate-Programs-in-Statistical-Science.aspx

6 Student Experience

The department student experience is emerging. Most courses have clear learning outcomes spelled out in details and students know about them but more needs to be done in this area and 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 Department of Mathematics and Statistics would need to publicize these learning objectives that students are expected to learn in course outlines and on the Math Department web page to reach the highly developed stage. We intend to revise all of the course syllabi so that they contain a clear description of the learning objectives for the course. A positive activity has been the adoption of a new web-based placemement assessment system based on the ALEKS PPL system. The ALEKS PPL assessment system is being adopted across the CSU-system providing students with greater access to math placement.

Appendix

A Exit Interview Questions

Beginning in 2016, Department of Mathematics and Statistics started exit interviews with all graduating students. 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:

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.

Each scheduled, one hour interview session was a face-to-face conversation with the department chair. Students were interviewed one o two months prior to graduation. Over 30 undergraduate and graduate students were interviewed. Questions from the initial interview are listed below.

Analyzing the responses proved to be challenging for a variety of reasons including open-ended or unnecessary questions, responses that were difficult to quantify, and unclear objectives. Future versions of the exit interview will address these issues.

A.1 2016 Exit Interview Questions

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?

B Rubrics

Following are rubrics for Learning Goals 2 and Learning Goals 4.

B.1 Topic of Assessment: Learning Goal 2

Being able to prove statements and communicate the validity of the proof to others is an essential skill to be practiced in the upper-division courses of the degree program. This assessments aims to evaluate whether students are able to formulate a proof. We assess **two** proofs:

- One proof should involve a conditional statement that may be proved by directly invoking the definition.

- A second proof should require one additional step, e.g., using the contrapositive, or proving a universal statement.

Emerging		**Developing**		**Mastering**	
1	**2**	**3**	**4**	**5**	**6**
Fails to identify the premises/conclusions of theorems/problems, uses incorrect mathematical symbols, or fails to follow a logical pattern in arguments. Appeals to intuition or common usage of terms.		Identifies the premises/conclusions of theorems/problems but does not use mathematically correct argument. Successfully identifies and summarizes the premises/conclusions of theorems/problems, devises a mathematically correct method to prove the theorem, but does not use correct symbols or fail to follow a logical pattern in argument.		Clearly identifies the premises/conclusions of theorems/problems, devises a mathematically correct method, and successfully explains the method using arguments that follows a logical pattern using correct mathematical symbols.	

Table 2: Rubric for Learning Goal 2: *The mathematics major at CSUS is expected to develop a fundamental understanding of the process and role of mathematical reasoning.*

B.2 Topic of Assessment: Learning Goal 4

This assessment may be done in conjunction with other learning goals. We analyze a students proof and determine how effective the student communicates the proof ideas with the outside world.

Emerging		**Developing**		**Mastering**	
1	**2**	**3**	**4**	**5**	**6**
The student does not use any written language to communicate any ideas. The student makes many mistakes in the syntax of mathematical statements.		The student attempts to communicate proof ideas in writing, but uses some incorrect or ambiguous terms. Use of mathematical symbolism conveys the correct idea, but is not quite correct, or uses unusual choices of symbols.		The student chooses the correct terminology and symbols. For true mastery, the student presents the proof elegantly without saying too much or too little.	

Table 3: Rubric for Learning Goal 4: *The mathematics major at CSUS is expected to demonstrate an ability to effectively communicate mathematical thought.*