College of Science and Mathematics
Department of Mathematics
M.S. in Mathematics
Student Outcomes Assessment Plan (SOAP)

I. MISSION STATEMENT

The graduate program of the Department of Mathematics at California State University, Fresno offers a high quality education to qualified students at the Master's level. The program provides students with opportunities for personal and career enhancement through advanced study. Its goal is to prepare students for work in industry, advanced study in doctoral programs, and assumption of a leadership role in mathematics education. The program emphasizes quality teaching and offers close interaction between faculty and students.

II. INSTITUTIONAL LEARNING OUTCOMES, PROGRAM LEARNING OUTCOMES/GOALS, AND SLO'S

A. Fresno State Institutional Learning Outcomes.

Student who graduate from California State University, Fresno will demonstrate the importance of discovery, diversity, and distinction by

1. **developing a foundational, broad and integrative knowledge** of the humanities, the arts, the sciences, and social sciences, and their integration with their major field of study. Students will consolidate learning from different fields and explore the concepts and questions that bridge those essential areas of learning. Graduate students will articulate the significance, implications and challenges within their field in a societal and global context. In fields in which interdisciplinarity is fundamental, graduate students will further draw from the perspectives of other domains of inquiry/practice so as to assess a problem better and offer solutions to it.

2. **acquiring specialized knowledge** as identified by program learning outcomes in their major field. Students will demonstrate expertise in a specialized area of study, including integration of ideas, methods, theory and practice. Graduate students will demonstrate

further mastery of the field's theories, research methods, and approaches to inquiry. They will also show the ability to assess major contributions to the field, as well as expand on those contributions through empirical research or aesthetic exploration.

3. **improving intellectual skills** including critical thinking, effective oral and written communication, information literacy and quantitative reasoning. Students will demonstrate fluency via application of these skills to everyday problems and complex challenges. Graduate students will hone these skills further, demonstrating coherent arguments, analysis, insight, creativity, and acumen as they address local, regional, and global issues in their respective fields of study.

4. **applying knowledge** by integrating theory, practice, and problem solving to address real world issues using both individual and team approaches. Students will apply their knowledge in a project, paper, exhibit, performance, or other appropriate demonstration that links knowledge and skills acquired at the university with those from other areas of their lives. Graduate students will integrate knowledge and skills from coursework, practicum, and research to address critical issues in their field and demonstrate advanced application of knowledge through a culminating experience that validates, challenges, and/or expands the profession's body of knowledge.

5. **exemplifying equity, ethics, and engagement.** Students will form and effectively communicate their own evidence-based and reasoned views on public issues, interact with others to address social, environmental and economic challenges, apply knowledge of diversity and cultural competencies to promote equity and social justice in the classroom and the community, value the complexity of ethical decision making in a diverse society, acknowledge the importance of standards in academic and professional integrity, and demonstrate honesty, tolerance, and civility in social and academic interactions. Building upon this at the graduate level, students will apply these values in the creation of scholarly and/or aesthetic works that enrich the human experience.

B. Program Learning Outcomes.

Goal A. Knowledge of Mathematics. Students will acquire advanced knowledge in pure and applied mathematics, and in mathematics education, at the graduate level.

Student Learning Outcomes. Graduates will be able to:

A1. learn and understand advanced concepts in abstract algebra, analysis, and other pure mathematics topics.

A2. demonstrate their knowledge and understanding of applied mathematics topics, such as mathematical modeling and applications of operator theory and functional analysis, and their ability to analyze problems in those areas.

A3. understand mathematics education theories and research methodologies.

Goal B. Communicating Mathematics. Students will continue learning to read, understand, and write rigorous mathematical proofs and other academic arguments, which they will communicate orally and in writing.

Student Learning Outcomes. Graduates will be able to:

B1. reconstruct proofs of classical theorems and/or write rigorous, multi-concept proofs using advanced concepts in pure mathematics, such as transformation, Lebesgue integral, uniform convergence, matrix groups, topological spaces, algebraic structures, etc.

B2. effectively communicate their analysis of problems in applied mathematics and the interpretation of their results.

B3. communicate the relationships among mathematics education theories, the gaps in the current literature, and what methods would be most applicable to investigating particulate mathematics education topics.

B4. use software to perform mathematical analysis, to prepare professional written reports, and/or to create effective presentations.

Goal C. Applications of Mathematics. Students will apply mathematical knowledge to solve theoretical and practical problems in pure and applied mathematics, and in mathematics education.

Student Learning Outcomes: Graduates will be able to:

C1. apply the structural relationships among the various advanced concepts in pure mathematics to solve problems.

C2. use their knowledge of mathematics to examine new situations, analyze problems, and interpret their results.

C3. use their knowledge of mathematics education theories and research methods to plan research studies in mathematics education that would address gaps in the literature.

C4. demonstrate their ability to use mathematical software to enhance their computational and visualization skills.

III. CURRICULUM MAP (MATRIX OF COURSES $\times$ LEARNING OUTCOMES)

For courses in the major, we will use the abbreviations below to indicate which outcomes are introduced, which are reinforced, which are emphasized, and which are mastered in that particular course.

I = Introduced **R = Reinforced** **E=Emphasized** **M=Mastered**

Note: The M.S. in Mathematics program has two core courses (MATH 251 and MATH 271). Also, students have to choose two of their electives from a certain predetermined set of courses as follows:

- Choose one of the following: MATH 232, MATH 252, MATH 272, or MATH 200.
- Choose one of the following: MATH 223, MATH 228, MATH 260.

where MATH 232 and MATH 223 are considered to be applied courses, and MATH 252, MATH 272, and MATH 228 to be pure mathematics courses. MATH 200 and MATH 260 are to be taken by students interested in teaching or mathematics education. Finally, students must enroll in MATH 298 or MATH 299 in their final semester.

	SLO A1	SLO A2	SLO A3	SLO B1	SLO B2	SLO B3	SLO B4	SLO C1	SLO C2	SLO C3	SLO C4
Required Courses											
MATH 251	R			R				R			
MATH 271	R			R				R	I		
Suggested Courses											
MATH 200			I			I	R			I	
MATH 223		I			R				R		I
MATH 228	R			R				I	I		
MATH 232		R			R		R		R		R
MATH 252	E			E				R			
MATH 260	R			I			R	I			R
MATH 272	E			E				R			
Elective Courses											
MATH 201			R			I	R			I	
MATH 216T	R			R			I	I			
MATH 220	R			I			I	R	I		R
MATH 263	I			R				I			
MATH 290		E	E	E	E	E	E	E	E	E	E
MATH 298		M			M	M	M	M	M	M	M
MATH 299		M			M	M	M	M	M	M	M

Note: The SLOs assessed in graduate courses are, most of the times, introduced in undergraduate coursework. Hence, most of our graduate courses Reinforce, Emphasize, or strive to get students to Master such SLOs.

IV. ASSESSMENT METHODS

Our assessment measures focus mostly on two main objectives: to assess all our courses: core courses more often than the others, and to assess Projects/Theses.

A. Direct Measures:

1. Summative assessment of all our courses, on a rotating basis, by looking into:

   (a) Embedded questions on exams, midterms and/or finals; and/or

   (b) Using a rubric to assess projects in classes that do not offer final exams.

   (c) disaggregate the data collected by demographic groups for at least one SLO each academic year. Also, the program's assessment coordinator will use the Office of Institutional Effectiveness's database and/or CSU Chancellor's Office database to access disaggregated data related to department or program student success.

   Note that for certain SLOs, rubrics may be needed to assess mathematical writing or oral communication of mathematics;

   We will implement Direct Measure 1 following the schedule described on the table in Section VI. We will repeat this cycle every four years.

2. We will collect data based on our department rubric for each Project (MATH 298). Each member of a project committee will submit a rubric on the writing and quality of work of the Project and on the quality of the defense. These rubrics will be reviewed and evaluated every 5 years.

3. We will collect data based on our department rubric for each Thesis (MATH 299). Each member of a thesis committee will submit a rubric on the writing and quality of work of the Thesis and on the quality of the defense. These rubrics will be reviewed and evaluated every 5 years.

B. Indirect Measures: We will administer and collect various surveys. The results of these surveys will be reported annually, while aggregated survey results will be analyzed every five years.

4. Exit surveys, and focus groups with graduating students in which topics in the survey are discussed.

5. Alumni surveys.

V. STUDENT LEARNING OUTCOMES × ASSESSMENT METHODS MATRIX

	SLO A1	SLO A2	SLO A3	SLO B1	SLO B2	SLO B3	SLO B4	SLO C1	SLO C2	SLO C3	SLO C4
Direct Measures											
1	X	X	X	X	X	X	X	X	X	X	X
2		X			X	X	X	X	X	X	X
3		X			X	X	X	X	X	X	X
Indirect Measures											
4	X	X	X	X	X	X	X	X	X	X	X

VI. TIMELINE

Direct/Indirect measures 2-5 will be carried out annually, if data is available. Direct measure 1 will be scheduled as follows:

FALL 2024	
MATH 200	Research Methods in Math Education
SPRING 2025	
MATH 228	Functions of a Complex Variable
MATH 251	Abstract Algebra I

FALL 2025	
MATH 271	Real Analysis
MATH 216T	Topics in Number Theory
SPRING 2026	
MATH 220	Coding Theory
MATH 260	Modern Geometry

FALL 2026	
MATH 232	Mathematical Models with Technology
MATH 263	Point-set Topology
SPRING 2027	
MATH 223	Applied Operator Theory
MATH 251	Abstract Algebra I

FALL 2027	
MATH 271	Real Analysis
MATH 201	Cognition in Math Education
MATH 252	Abstract Algebra II
SPRING 2028	
MATH 272	Functional Analysis

We will repeat this cycle every four years.

Multi-year reports will be scheduled as follows:

2024-2025.

- Report on Measure 2.

2025-2026.

- Report on Measure 3.

2026-2027.

- Report on exit surveys and exit interviews (Measure 4).

2027-2028.

- Report on alumni surveys (Measure 5).

2028-2029.

- Evaluation of surveys, forms, rubrics, etc. used in assessment. Redesign of these, if needed.

We will repeat the cycle 2024-2029 every five years.

VII. PROCESS FOR CLOSING THE LOOP

The assessment committee will meet annually to review the results of the assessment activities and determine areas where curriculum changes may be necessary. The report detailing the review and recommendations will be forwarded to the department.
There will be an annual department meeting at the beginning of each academic year, dedicated exclusively to the discussion of the recommendations put forth by the assessment committee. If at that time the department decides to act on the committee's recommendations, ad hoc committees will be created to implement them. The results and outcomes of each ad hoc committee's work will be included in the following year's assessment report.

Last Revision: September 2024.