

UNIVERSITY OF SAN FRANCISCO
College of Arts and Sciences

Mathematics—Program Assessment Plan

As requested by the administration, we have prepared a draft assessment plan for the Department of Mathematics. This plan includes preliminary versions of learning goals, learning outcomes, a curriculum map and rubrics to benchmark performance. This draft plan will be discussed at the Department's October meeting (October 14). We anticipate that after this meeting, we will be able to finalize this part of the assessment plan. Note: Our learning goals and outcomes are closely modelled on those of the Department of Mathematics at the University of Colorado.

Program Learning Goals

The degree in mathematics emphasizes knowledge and awareness of:

- Basic real analysis of one variable;
- Calculus of several variables and vector analysis;
- Basic linear algebra and theory of vector spaces;
- The structure of mathematical proofs and definitions; and
- At least one additional specialized area of mathematics.

Program Learning Outcomes

Students completing a degree in mathematics are expected to acquire the ability and skills to:

1. Use techniques of differentiation and integration of one and several variables;
2. Solve problems using differentiation and integration;
3. Solve systems of linear equations;
4. Give direct proofs, proofs by contradiction, and proofs by induction;
5. Formulate definitions;
6. Read mathematics without supervision;
7. Utilize mathematics; and
8. Use technology to solve mathematical problems.

Curriculum Map

Note: 'I' denotes 'introduced with minimal coverage,' 'M' denotes 'moderate coverage,' and 'C' denotes 'comprehensive coverage.'

Outcome

Major Course	Outcome							
	1	2	3	4	5	6	7	8
Math 109, Calc I	C	C				I	M	
Math 110, Calc II	C	C				I	M	
Math 130, Lin Alg			C			I	M	
Math 211, Calc III	C	C	I			I	M	
Math 235, Form Methods				C	C	M	M	
Math 310, Hist Math	I	I	I	M	M	C	M	
Math 314, Math Circles	I	I	I			I	C	
Math 340, Diff Eqns	C	C	I			I	C	M
Math 345, Modelling	C	C	C			I	C	M
Math 355, Complex	M	M		C	C	M	M	
Math 367, Number Thry				C	C	M	M	
Math 370, Prob Stats	M	M	M			M	C	M
Math 380, Fnd Geometry				C	C	M		
Math 394, Appl Math Lab	M	M	M			C	C	C
Math 422, Combinatorics			M	C	C	M	C	
Math 435, Mod Algebra			M	C	C	M	M	
Math 453, Real Analysis	M	M	M	C	C	M		
Math 482, Diff Geometry	M	M	M	C	C	M		
Math 485, Topology	M	M	M	C	C	M		
CS 110, Intro to CS I							M	C
Phys 301, Comp Physics	M	M	M				M	C

Rubrics

Note: A student's inability to achieve acceptable performance constitutes unacceptable performance.

Outcome Acceptable Exemplary

Outcome	Acceptable	Exemplary
1. Differentiate and integrate functions of one and several variables	Differentiate and integrate simple algebraic and transcendental functions	Differentiate and integrate complex algebraic and transcendental functions
2. Solve problems using differentiation and integration	Find simple extrema, areas and volumes; applications to physics	More complex extrema, areas and volumes; applications to other areas
3. Solve systems of linear equations	Solve linear systems using Gaussian elimination and LU LU factorization	Acceptable level and ability to apply linear algebra to optimization and geometry
4(a) Give direct proofs	Construct short proofs involving only a few implications	Construct proofs requiring longer chains of reasoning and more insight
4(b) Give proofs by contradiction	Construct short proofs comparable to $\sqrt{2}$ is irrational	Construct more difficult proofs, such as uncountability of the real numbers
4(c) Give induction proofs	Construct proofs of simple summation formulas	Construct more difficult proofs requiring strong induction or the well-ordering principle
5. Formulate definitions	Able to formulate complex definitions to which student has been exposed in class	Given an inchoate description of a mathematical object, able to formulate precise definitions
6. Read mathematics without supervision	Able to reproduce the substance of a mathematical argument in a senior-level textbook	Able to reproduce the substance of a mathematical argument in a graduate-level text or research paper
7. Utilize mathematics	Able to use mathematics to solve straightforward problems in some discipline (including mathematics)	Able to use mathematics to solve more complex problems in some discipline
8. Use technology to solve mathematical problems	Able to use software to generate numerical, graphical, or statistical solutions to basic mathematical problems	Able to use software to generate solutions to more sophisticated mathematical problems