

Math Department Assessment Report 2010/2011

Outcomes - BA Mathematics & BA Mathematics - Preparation for Teaching

Goal 1 The Ability to Use and Construct Logical Arguments

The ability to reason logically to conclusions, including the ability to use precise definitions and to use various forms of logical argument.

Specific Learning Objectives to be assessed:

1. Ability to give direct proofs
2. Ability to give proofs by contradiction
3. Ability to give proofs by mathematical induction
4. Ability to apply definitions to give proofs
5. Ability to give proofs and disproofs involving quantified statements

Students are introduced to Goal 1 and the associated learning objectives in Math 42 Discrete Math, these learning objectives are reinforced in Math 108 Introduction to Proof (where these learning objectives are evaluated). Mastery of these learning objectives is required in the upper division theoretical math courses including Math 128AB, Math 129B, and Math 131AB. In Fall 2010 Dr. Blockus taught Math 108 and collected assessment data for Goal 1 using embedded questions in her midterms and final. She is in the process of writing up her report which will then be reviewed by the Undergraduate Curriculum Committee and the department chair to see if any additional action is warranted.

Goal 2 The Ability to Communicate Mathematics Effectively

The ability to read mathematics with understanding and to communicate mathematical ideas with clarity and coherence.

Specific Learning Objectives to be assessed:

1. Ability to state a problem accurately, articulate assumptions, and describe a method of solution
2. Ability to conduct independent investigation of mathematical concepts at the undergraduate level
3. Ability to give written reports and oral presentations that include mathematical context which is mathematically accurate, yet accessible to classmates

Students are introduced to Goal 2 and the associated learning objectives in Math 100W, these learning objectives are reinforced in Math 104 History of Math (where these learning objectives are evaluated for the BA Math degrees), Math 161B (where these learning objectives are assessed for the BS Applied Math degrees), and a variety of upper division math courses where students are required to write reports and give presentations. Data will be collected to assess these learning objectives in Fall 2012.

Goal 3 The Ability to Perform Standard Mathematical Computations

Specific Learning Objectives to be assessed:

1. Ability to evaluate limits
2. Ability to calculate derivatives and integrals
3. Ability to apply properties of algebraic and transcendental functions

Students are introduced to Goal 3 and the associated learning objectives in Math 19, 30/30P, 31, and 32, these learning objectives are reinforced in Math 138 Complex Analysis (where these learning objectives are evaluated for the BA Math degrees), and a variety of other upper division math courses including Math 112, Math 131AB, Math 132, Math 133AB, Math 134, and Math 143C/M. Data will be collected to assess these learning objectives in using embedded midterm and final exam questions in Math 138 during Fall 2011.

The Math Dept has recently implemented a variety of workshops in Precalculus and Calculus to help students succeed in these courses where these learning objectives are first introduced. Every semester grade data is analyzed to see how workshops should best be utilized for these various courses.

For Math 19 Precalculus we have the following data, for Spring 2002-Spring 2005 the average passing rate (C or higher) was 55.99% (no placement exam was used and no workshops were given), for Fall 2005-Spring 2008 the average passing rate was 59.35% (a placement exam was used and no workshops were given), for Fall 2008-Spring 2009 the average passing rate was 66.29% (a placement exam was used and students were required to sign up for workshops which met 50 minutes twice a week), for Fall 2009-Spring 2010 the average passing rate was 73.51% (a placement exam was required and students were required to sign up for workshops which met for 75 minutes twice a week), and for Fall 2010 the passing rate was 73% (the placement exam eliminated due to severe staff cuts in the Math Department office). The data indicates that while a placement is somewhat useful in getting students to succeed in Precalculus, the effect of requiring students to sign up for Precalculus workshops which meet 75 minutes per week is much greater. Because of this Math 19W was changed to a 1 unit lab so we could continue to schedule the workshops to meet 75 minutes twice a week, and the College of Science is in the process of applying to have additional workshop rooms constructed for the Math Dept in WSQ 001.

In Math 30 Calculus I and Math 30P Calculus I with Precalculus students are taught to evaluate limits and to compute derivatives for the first time. For Math 30P we have the following grade data, Spring 2002-Spring 2007 (students taking Math 30 are required to take a placement exam so 90% of Calculus I students take Math 30P and no workshops are offered) the average passing rate (C or higher) was 59.78%, Fall 2007-Fall 2008 (students who get a B or higher in Math 19 are allowed to take Math 30 so only 60% Calculus I students take Math 30P and no workshops are offered) the average passing rate was 54.29%, Spring 2009 (students are required to sign up for workshops which meet 50 minutes twice a week) the average passing rate was 57.96%, Fall 2009-Fall 2010 (students are required to sign up for workshops which meet 75 minutes twice a week) the average passing rate was 69.00%. The data indicates that while requiring a placement exam for students who want to take the 3-unit Math 30 instead of the 5-unit Math 30P was helpful in getting students to succeed in Calculus I, the effect of requiring students to sign up for Calculus I workshops which meet 75 minutes per week is greater. Because of this Math 30W was changed to a 1 unit lab so we could continue to schedule the workshops to meet 75 minute per week, and the College of Science is in the process of applying to have additional workshop rooms constructed for the Math Dept in WSQ 001.

In Math 31 Calculus II students learn how to evaluate integrals for the first time. For Math 31 Calculus II we have the following data, for Fall 2005-Spring 2009 (no workshops were offered) the average passing rate (C- or higher) was 62.73%, Fall 2009-Spring 2010 (students were required to sign up for 75 minute workshops) the average passing rate was 69.74%, and for Fall 2010 students were required to sign up for 50 minute workshops) the average passing rate was 65.12%. The data shows that while workshops are not quite as effective as increasing the passing rates in Calculus II, as they are in Precalculus and Calculus I, the effect of 75 minute workshops is much greater than the effect of 50 minute workshops.

Goal 4 The Ability to Use Technology to Solve Mathematical Problems

Specific Learning Objectives to be assessed:

1. Ability to write programs to solve mathematical problems
2. Ability to use a mathematical programming environment such as MATLAB or Maple
3. Ability to interpret numerical results
4. Ability to understand that there are limits to numerical accuracy

Students are introduced to technology in Precalculus and Calculus (graphing calculators and mathematical software), Linear Algebra (MATLAB). In addition, all Math majors are required to take a programming course in some language Math 50 (Fortran), Math 109 (MATLAB or Maple), Math 167 (SAS), or CS 46A (Java), CS 49C (C), or CS 49J (Java). BA Math majors and BS Applied Math majors are assessed for these learning objectives in CS 143C/M Numerical Analysis and Scientific Programming where they are required to do some kind of a programming project. Programming projects and mathematical software are also sometimes required in other upper division math courses as well including Math 133AB, Math 177, Math 178, and Math 179. Data for assessing these learning objectives will be collected in Fall 2012 using data from Math 143M.

Outcomes - BS Applied Mathematics

Goal 1 The Ability to Communicate Mathematics Effectively

The ability to read mathematics with understanding and to communicate mathematical ideas with clarity and coherence.

Specific Learning Objectives to be assessed:

1. Ability to state a problem accurately, articulate assumptions, and describe a method of solution
2. Ability to conduct independent investigation of mathematical concepts at the undergraduate level
3. Ability to give written reports and oral presentations that include mathematical context which is mathematically accurate, yet accessible to classmates

See Goal 2 above.

Goal 2 The Ability to Perform Standard Mathematical Computations

Specific Learning Objectives to be assessed:

1. Ability to evaluate limits
2. Ability to calculate derivatives and integrals
3. Ability to determine regions of convergence
4. Ability to apply properties of algebraic and transcendental functions

See Goal 3 above.

Goal 3 The Ability to Use Technology to Solve Mathematical Problems

Specific Learning Objectives to be assessed:

1. Ability to write programs to solve mathematical problems
2. Ability to use a mathematical programming environment such as MATLAB or Maple
3. Ability to interpret numerical results
4. Ability to understand that there are limits to numerical accuracy

See Goal 4 above.

Goal 4 The Ability to Use Mathematical Models to Solve Practical Problems

Specific Learning Objectives to be assessed:

1. Ability to extract relevant information from a practical problem and give a mathematical formulation of the problem
2. Ability to use numerical results to validate (or modify) a model and to understand the limitation of a model
3. Ability to clearly describe models, including an analysis of the strengths and weaknesses of models and their relationship to the underlying problem

Goal 4 and its associated learning objectives are introduced in Precalculus and Calculus, reinforced in Math 178 (where the learning objectives are evaluated). These learning objectives are also reinforced to some extent in a variety of other upper division courses including Math 129A Linear Algebra, Math 133AB Ordinary and Partial Differential Equation, Math 134 Dynamical Systems, Math 142 Combinatorics, Math 161AB Applied Statistics, Math 162 Statistics for Bioinformatics, Math 163 Probability, Math 177 Linear Optimization, and Math 179 Graph Theory. Data is being gathered to assess these learning objectives using embedded midterm and final exam questions in Math 178 by Richard Low who is teaching that course this spring. Once he turns in his report it will be evaluated by the Undergraduate Curriculum Committee and the Math Department chair who will determine whether or not any further actions are needed.

**Outcomes - MS Mathematics and MA Mathematics and MA Mathematics,
Concentration in Mathematics Education**

**Goal 1 The Ability to Read, Understand, and Explicate Journal Articles in
Mathematics Related to the Student's Area of Specialty**

Goal 2 The Ability to Communicate Mathematics Effectively

1. Ability to explain mathematics orally
2. Ability to write clear mathematical explanations

Data was gathered and evaluated at the end of Fall 2010 by Dr. Richard Kubelka, the Math Department Graduate coordinator to assess these learning objectives. His report is now being discussed by the Graduate Curriculum Committee to determine whether or not any additional actions are warranted.