

Mathematics Department Undergraduate Program Assessment
Program Goals and Learning Outcomes
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Knowledge in introductory courses (calculus and pre-calculus courses)

As is well-known, the Mathematics Department at Penn State University services a vast number of students each year in “service” courses, especially in calculus and pre-calculus courses (including MATH 021, 022, 026, 041, 110, 140, and 141). Given the magnitude of this aspect of the department’s program, it is essential that the department assess student learning outcomes in these courses. As such, the following goals have been developed:

G1: Students should be able to work with functions presented in a variety of formats – graphical, numerical, analytical, and verbal.

G2: Students should be able to derive the solutions to various mathematical problems.

G3: Students should be able to communicate solutions of mathematical problems effectively, especially in written form.

G4: Students should be able to model a written description of a physical situation with a function, differential equation, or integral.

G5: Students should be able to determine the reasonableness of solutions, including signs, size, relative accuracy, and units of measurement.

In order to assess these goals, various questions will be asked in both pre-test and post-test form in a number of our introductory courses each semester. (The primary courses which will be involved in this process initially will be MATH 140 and MATH 141.) Student responses to these questions will be tracked to determine whether students satisfied these goals satisfactorily.

Knowledge and skills in the major program

Although students in the mathematics majors choose a wide variety of upper-level courses (to satisfy requirements in one of our seven major options), there are certainly a number of “core” courses completed by almost all of our majors. The following goals have therefore been written with this in mind.

G1: Students should be able to demonstrate an understanding of the core concepts of differential and integral calculus, elementary linear algebra, and differential equations by solving problems within these disciplines.

G2: Students should be able to describe physical situations mathematically.

G3: Students should be able to apply mathematical proof techniques in a wide variety of mathematical areas, including algebra and analysis.

G4: Students should be able to demonstrate skill in effectively communicating mathematical concepts and proofs, especially in written form.

G5: Students should be able to demonstrate a breadth and depth of understanding within mathematics.

In order to assess these goals, various questions will be asked in both pre-test and post-test form in a number of our upper-level courses each semester. Student responses to these questions will be tracked to determine whether students satisfied these goals satisfactorily. The courses which have been selected for initial involvement in this process are MATH 311W, 312, 403, and 436. Additional courses will be assessed in future years.

Experiential learning opportunities for majors

It is becoming increasingly clear that mathematics majors benefit greatly from learning experiences which occur outside of the typical “residential instruction” classroom. With this in mind, the following goal is significant:

G1: Students will be encouraged to complete at least one learning experience which occurs outside of the “typical” Penn State classroom experience.

Admittedly, this is a very broad goal; such breadth may actually be a strength of this goal. However, the Mathematics Department believes that there are numerous ways in which each student may achieve this goal. An extensive list of such possibilities will be obtained via the department’s existing “exit survey” for graduating mathematics majors. However, a brief list may be included here: research experiences via REU programs or the department’s Center for Undergraduate Research in Mathematics (CURM) which provides opportunities for students to complete research throughout their college career, study abroad programs, co-op programs, summer internships (especially for those pursuing the mathematics actuarial option), work experiences at regional locations such as Penn State’s Applied Research Laboratory, and tutoring at the Math Center on campus (especially for those in the mathematics teaching option).

Academic and professional advising for majors

Advising in the Mathematics Department is extremely important as we strive to serve our majors in the best way possible. With this in mind, the following goals arise:

G1: Students will receive effective academic advising at every stage of their college career.

G2: Students will be prepared to succeed after graduation, either in a career of their choice or in placement to graduate programs in mathematics and related fields.

Assessment in this area will occur in multiple ways, including the following:

- Students will be surveyed at the end of the MATH First-Year Seminar course about the usefulness of the advising-related presentations that are given in that course.
- Majors will be surveyed near the completion of their degree program to ascertain their beliefs and attitudes related to the advising received from the advising corps in the department. This will include questions on their attitudes towards the academic advising and professional advising received, as well as information related to their plans after graduation. The department has been collecting such “exit data” for a number of years, so benchmarking can now be done to ascertain whether students continue to be prepared for careers and graduate programs once they complete their undergraduate education at Penn State.