

FORM E-1-A FOR BOSTON COLLEGE DEPARTMENTS/PROGRAMS

DEPARTMENT OF MATHEMATICS
UNIVERSITY CORE
2020

- 1) Have formal learning outcomes been developed? What are they? (What specific sets of skills and knowledge does the department expect students completing its Core courses to have acquired?)

In a Core course in Mathematics, students should:

- learn the nature of mathematical inquiry: abstraction and generalization;
- understand the power of mathematical reasoning to reach conclusions with assurance;
- communicate solutions clearly and effectively;
- study and appreciate applications of mathematics to other disciplines.

- 2) Where are these learning outcomes published? Be specific. (Where are the department's expected learning outcomes for its Core courses accessible: on the web, in the catalog, or in your department handouts?)

A statement of the department's commitment to assessing the success of our students, with descriptions of our goals, is available on the University Core website at

https://www.bc.edu/bc-web/schools/mcas/undergraduate/core-curriculum/core-requirements.html#1_course_in_mathematics.

- 3) Other than GPA, what data/evidence is used to determine whether students have achieved the stated outcomes for the Core requirement? (What evidence and analytical approaches do you use to assess which of the student learning outcomes have been achieved more or less well?)

The department's procedure is to collect evidence in two ways, direct and indirect.

- (1) The Undergraduate Committee will periodically review final exams in specifically identified courses and rate carefully chosen problems with regard to the learning goals.
- (2) The Undergraduate Committee will review student evaluations for those identified courses. If possible, instructors will be asked to add extra questions, designed by the Committee, to directly address the learning goals.

- 4) Who interprets the evidence? What is the process? (Who in the department is responsible for interpreting the data and making recommendations for curriculum or assignment changes if appropriate? When does this occur?)

The department's Undergraduate Committee, chaired by the Assistant Chair for Undergraduates, is charged with assessment. The committee reviews the data described in item 3 during the fall semester, with the goal of recommendations to the full department in the spring.

- 5) What were the assessment results and what changes have been made as a result of using this data/evidence? (What were the major assessment findings? Have there been any recent changes to your curriculum or program? How did the assessment data contribute to those changes?)

Following on assessments made in previous years, the department initiated two major changes to our (by far) largest core offerings, MATH1100/1 Calculus I,II.

- (1) For all but two sections of MATH1101 in the Spring (see item 2 below), these courses were made more uniform. Syllabi, homework assignments, and exams were common. One faculty member coordinated the multiple sections of each course. The instructors (some faculty and some teaching fellows) were responsible for writing their own lectures, but adhered to a common topics list and lecture schedule.
- (2) In the Spring, the department tested a revised curriculum for Calculus II, whose audience is primarily students in life sciences, economics, and other social sciences. This curriculum was used with 51 students, in two sections. The goals of the revised curriculum were:
 - to modernize 1101 to reflect less emphasis on computing techniques which can be done by computers and more need for ability to apply concepts of calculus and work with functions of multiple variables;
 - to increase relevance of the course for all students.

These pilot sections of 1101 covered the same topics as the others, with the exception of NOT covering advanced integration techniques, volumes via integration, or polar coordinates, and instead covering multivariable functions and derivatives.

The pilot was a success, in two senses. In terms of content understanding, the multivariable material was challenging but within reach. In homework and exam settings, students were generally able to interpret and compute with multivariable functions and derivatives, work with them visually and do some foundational problem solving, from such areas as optimization and linear approximation. Students seemed motivated and engaged with the new material. This conclusion is supported by responses to a question posed on the final

exam:

Which topic in Calculus II have you most enjoyed learning about or do you find most interesting?

Slightly more than 50% reported “multivariable calculus”. The next topic mentioned was “systems of differential equations” at about 20%. The applicability of these topics and connections to other fields and courses (Eco/Evo, Economics) were common reasons students appreciated these topics. This is encouraging as it aligns with the learning goals of the course which include problem solving and modeling with mathematics.

The department will continue with the pilot curriculum next year and fine tune topics and textbooks, as well as collect data to compare with previous years.

- 6) Date of the most recent program review. (Your latest comprehensive departmental self-study and external review.)

The department conducted a self study in the Fall of 2007, which was followed by an external review on April 24-25, 2008.