

Mathematics General Education Program 2009/10

Introduction

The math department serves two important roles in the general education of OIT students: (1) Students receive basic mathematical training expected of any college graduate. (2) Students receive major-specific mathematical training in support of courses taken in their majors.

Mission

All OIT students will receive a basic mathematics education expected of a college graduates. Those needing it will receive further instruction in support of their major courses of study.

Educational Objectives

Individuals having completed their required math courses at OIT will have an understanding of the fundamental skills of mathematics, and will understand and be able to apply mathematical concepts as needed in their major courses and daily lives.

Expected Student Learning Outcomes

Upon completion of their required math courses, students will be able to

1. apply mathematical concepts and principles to perform symbolic computations
2. create, use and analyze graphical representations of mathematical relationships
3. use mathematical concepts and techniques to solve applied problems

Data Collection/Assessment Schedule

The following table indicates the three year cycle for assessing the learning outcomes.

Program Student Learning Outcomes	Academic Year Assessed		
	'08-9	'09-10	'10-11
1. Apply mathematical concepts and principles to perform symbolic computations.	X		X
2. Create, use and analyze graphical representations of mathematical relationships.	X	X	
3. Use mathematical concepts and techniques to solve applied problems.	X		

Table 1: Assessment schedule.

2009-10 Assessment Activities

In the past, the math department has encountered various difficulties with assessment due to a lack of outcomes and performance criteria for individual courses. An ongoing, concerted effort has taken place to create course outcomes and performance criteria. These were created for Math 111, 251 and 254N during the spring term of 2009. Outcomes and criteria were created for Math 252 and Math 112 in the fall of 2009. Each course has two types of criteria:

- 1) *Core Criteria* – These are criteria that all members of the department agreed were essential to the course. We also all agreed that these were criteria that students could expect to potentially be asked to demonstrate in a test situation, regardless of who was teaching the course.
- 2) *Non-Core Criteria* – These are criteria which many of us expect students to demonstrate, but that not all agreed on as essential to the course. It is each individual instructor's discretion as to whether or not to expect students to demonstrate these criteria in a test situation.

Outcomes and course criteria can be found at the Math Department web page:
www.oit.edu/programs/math

The Student Learning Outcomes/Course Curriculum matrix (see Appendix A) was then developed as follows:

- If a course has three or more performance criteria in any one of the outcomes of computation, graphing or application, then that outcome is considered to be *emphasized* in that course.
- If a course has some performance criteria in any one of the outcomes, but not at least three core criteria, then that outcome is considered to be *addressed* in that course.
- If a course has no performance criteria in one of the outcomes, then that outcome is *not addressed* in that course.

With these things in place, we feel we are now ready to assess our outcomes in the appropriate courses, and with consistency.

During the 2009-10 academic year, the Mathematics Department conducted assessment of one student learning outcome:

Outcome 2: *Create, use and analyze graphical representations of mathematical relationships.*

This outcome was assessed in Math 111, Math 243 and Math 251 during the fall term of 2009, and in Math 251 during the Winter term of 2010. The Math 111 assessment also served as a re-assessment associated with the 2008-09 assessment of the institutional student learning outcome in math. For additional information, see www.oit.edu/provost/learningoutcomes/gened/math).

In each of these courses, final exams given in all sections of the course contained questions related to this outcome. For the purposes of assessment, students' answers were recorded as correct or incorrect, and a student was considered proficient in this outcome if they answered two or more of three questions (Math 243 and 251) or three or more of five questions (Math 111) correctly. Moreover, students getting three of the three questions correct (Math 243 and 251) or

four or five of the five questions correct (Math 111) were deemed highly proficient. Results were as follows:

Level of Proficiency	Course			
	Math 111	Math 251	Math 243	Math 361
Proficient	21.6%	41.3%	32.3%	43.3%
Highly Proficient	37.1%	26.1%	61.3%	41.7%
Proficient or Highly Proficient	58.7%	67.4%	93.5%	85.0%

Table 2: Percentages of students performing at various levels of proficiency.

The results for Math 243 and 361, the two statistics courses, are good. The results for Math 251 are acceptable. Examination of the individual questions used there reveals some weakness in determining limits graphically, while student performance in determining pointwise derivatives and the graph of a derivative function was acceptable. The Math Department saw no reason to take any special measures related to assessment results in Math 243, 251 or 361.

The results for Math 111 were considered unacceptable. Results from the re-assessment of Outcome 2, *Create, use and analyze graphical representations of mathematical relationships* in Math 111 resulted in little improvement from the fall 2008 results.

After some discussion, two members of the department tried some changes in their approach to the question relating to the graph of the inverse of a function. One department member gave the same question on their Winter 2010 final, but it was not multiple choice; students were given the graph of the function and asked to draw the graph of the inverse. Only three of 20 students (15%) were successful. This seemed to indicate that the multiple choice format was not the problem for students.

Another faculty member attended to that performance criterion more emphatically, having students practice it on several occasions in class and including a question over it on both an in-class quiz and an hour exam. 19 of 36 students (53%) in that section then correctly identified the graph of an inverse function on the final exam.

The math faculty agreed that in the fall 2010 term each person teaching Math 111 will include similar questions on either a quiz, hour exam, or both. The department will then reassess these items again on fall 2010 final exams.

Detailed assessment results are kept by Gregg Waterman, Assessment Coordinator for the Mathematics General Education Program.

Appendix A: Student Learning Outcomes/Course Curriculum

The courses listed in the following table are the core of the Mathematics Department's service courses, and are offered every term. The table indicates the extent to which each of the three student learning outcomes is addressed in each course. *Emphasized* indicates that there are at least three *core* performance criteria addressing that outcome, and *addressed* indicates that there are some performance criteria (core or non-core) addressing the outcome.

Course	Student Learning Outcome		
	Computation	Graphing	Application
Math 111	Emphasized	Emphasized	Addressed
Math 112	Emphasized	Emphasized	Emphasized
Math 243			
Math 251	Emphasized	Addressed	Emphasized
Math 252	Emphasized	Addressed	Emphasized
Math 254N	Emphasized	Addressed	Addressed
Math 321			
Math 361	Emphasized	Emphasized	Emphasized