

# **Mathematics General Education/Service Program**

## **Introduction**

Many OIT students take a significant number of mathematics courses. Although some are taking these courses for general education purposes, far more are taking them in support of coursework in their major courses of study.

## **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**

### **General Education**

Individuals having completed a math course for which Math 100 is a prerequisite will have an understanding of the fundamental skills of mathematics.

### **Service**

Individuals having completed math courses in support of their major degree programs will be able to

1. Apply mathematics and technology tools to solve problems.
2. Understand the use of mathematical tools and concepts in other fields.

## **Expected Student Learning Outcomes**

### **General Education**

Students completing one course for which Math 100 is a prerequisite will be able to

1. apply mathematical concepts and principles to perform symbolic computations
2. read and analyze quantitative information in various representations
3. interpret mathematical results

### **Service**

Students completing specialized mathematics coursework required by their major will be able to

1. apply mathematical concepts and principles to perform symbolic computations
2. read and analyze quantitative information in various representations

3. interpret mathematical results
4. use modeling to solve problems
5. apply technology tools to solve problems

## Data Collection/Assessment Schedule

The following table indicates the three year cycle (note that the fourth year is included to show where the cycle begins repeating) for assessing the learning outcomes.

|   | Academic Year Assessed |       |        |        |
|---|------------------------|-------|--------|--------|
| Learning Outcomes   | '07-8                  | '08-9 | '09-10 | '10-11 |
| 1. Apply mathematical concepts and principles to perform symbolic computations. | X                      |       |        | X      |
| 2. Read and analyze quantitative information in various representations         |                        |       | X      |        |
| 3. Interpret mathematical results   | X                      |       |        | X      |
| 4. Use modeling to solve problems   |                        | X     |        |        |
| 5. Apply technology tools to solve problems                                     |                        | X     |        |        |

## Assessment of Student Learning Outcomes

### Assessment of Program Learning Outcome 1, Fall 2007

**Outcome:** Apply mathematical concepts and principles to perform symbolic computations.

#### Measures (Activities) Used

Direct Measure: Students in several sections each of Math 111 and Math 252, and one section of Math 321, were given one (Math 111 and Math 252) or two (Math 341) exam problems (meaning they were incorporated into regular class exams or final exams) that required students to apply mathematical concepts and principles to perform symbolic computations. *It should be noted that the questions specifically isolated on this outcome alone.* Student work was graded according to a rubric that was specific to the question

asked (the rubric was common to all sections of a given course); points were awarded for correctly executing steps in solving the problem or problems. Copies of the problems and rubrics can be found in the Math Department assessment binder, kept by the department assessment coordinator.

**Indirect Measure:** Students in these same courses were given a questionnaire asking what they felt their ability level was in applying mathematical concepts and principles to perform symbolic computations, both in math classes and in courses in their major. They were also asked if they felt that their ability in applying mathematical concepts and principles to perform symbolic computations had improved while taking their current math course. A copy of the questionnaire can be found in the Math Department assessment binder, kept by the department assessment coordinator.

### **Analysis of Results/Strengths and Weaknesses:**

**Direct Measure:** Student scores overall followed the usual distribution of “haves” and “have nots.” That is (particularly with the Math 111 and 252 results), most of the students either did fairly well or fairly poorly, and few fell in the middle. For Math 111, 68% of the 41 students made significant errors, had little idea what to do, or both. On the other hand 26% of the Math 111 students received a score of 80% or better. Those percentages for Math 252 (56 students) were 41% and 39%, and for Math 321 (29 students) the percentages were 28% and 52%. Copies of the raw data can be found in the Math Department assessment binder, kept by the department assessment coordinator.

**Indirect Measure:** In Math 111, a slight majority (58%) of the 57 students felt their ability to apply mathematical concepts and principles to perform symbolic computations *in math courses* was good to excellent, and a few more (62%) felt their ability to apply mathematical concepts and principles to perform symbolic computations *in non-math courses* was good to excellent. For Math 252 (37 students) the figures were 68% and 78%, respectively, and for Math 321 (18 students) they were 83% and 89%.

In Math 111, 70% of the students felt that their ability to apply mathematical concepts and principles to perform symbolic computations had gotten better as a result of taking the course, and 12% felt their ability had gotten *much* better as a result of taking the course. The figures for Math 252 were 73% and 22%, and for 341 they were 56% and 33%. Copies of the raw data can be found in the Math Department assessment binder, kept by the department assessment coordinator.

### **Plans For Improvement**

It is the feeling of at least some members of the Mathematics Department that the key to improvement in this area is for students to practice more. All members of the department are continually experimenting with ways to motivate students to practice more, on their own and in a meaningful way.

It should be noted that the data indicates that student performance for this outcome does improve for those students that continue on to take additional courses beyond Math 111, so it seems that progress is being made!

## **Assessment of Program Learning Outcome 3, Winter 2008**

**Outcome:** Interpret mathematical results.

### **Measures (Activities) Used**

**Direct Measure:** Data for this outcome was collected from four sections of Math 111 and one section each of Math 251, 321 and 361 during the winter term of 2008. In all cases students were given an exam question in which they had to interpret results of a mathematical computation or graph. They were awarded one point (satisfactory) or zero points (unsatisfactory) for each of two criteria. Those students who performed satisfactorily on both criteria were considered to have satisfied the outcome. Copies of the problems and rubrics can be found in the Math Department assessment binder, kept by the department assessment coordinator.

### **Analysis of Results/Strengths and Weaknesses**

**Direct Measure:** Two of the sections of Math 111 used one exercise to assess this outcome, and two other sections used a different exercise. The percentage of students whose performance was proficient is given in the table below, by course/exercise.

| M111 Exer. 1 | M111 Exer. 2 | Math 251 | Math 321 | Math 361 |
|--------------|--------------|----------|----------|----------|
| 67%          | 83%          | 44%      | 77%      | 61%      |

As one can see, there range of proficiency rates varies by course a great deal. This is most likely a result of differences in the way that the tasks were framed within their respective examinations.

### **Plans For Improvement**

We do not feel that anything in this data is conclusive about how we might improve instruction in this area, or whether improvement is really needed. Our plans for the future are to take more care in assessing in a more consistent manner across courses.

## **Student Learning/Assessment Improvement Plan**

Two program student learning outcomes were assessed this year:

**Outcome 1:** *Apply mathematical concepts and principles to perform symbolic computations.*

For Outcome 1, results were not felt to be as good as we would like to see. It is felt that students need to spend more quality time on their own working with mathematical

concepts. Members of the department have, and will continue to, experiment with ways to motivate students to spend this time. Several department members are currently using WeBWorK, an online homework system, and some data has been gathered relating to its use. That data can be found in the Math Department assessment binder, kept by the department assessment coordinator.

**Outcome 3:** *Interpret mathematical results.*

Results for Outcome 3 were extremely varied. The overall feeling of the department is that student skills in this area are neither outstanding nor disappointing. It is clear that more care will need to be taken when assessing this in the future.

The area that we feel needs most attention at this point is further refinement and reorganization of our learning outcomes. In retrospect we think that Outcomes 1 and 3 above should actually be individual criteria under some broader outcomes. The department has determined a plan for revising our outcomes, and we will do that in a one-day retreat during the 2008 Fall Convocation. Greater consistency in assessing across courses and levels will receive greater attention in the future as well.