

Course Outcomes Guide (COG)

Directions: Please complete this form to document your progress toward improving student learning. For each item, indicate your progress and your anticipated next steps. Thank you!

Course Title: Calculus III, Math 205

Date: Spring 2014

Course Team: Christopher J. Lewis

Expected Learning Outcomes

STUDENT LEARNING OUTCOMES:

In this course students will acquire:

- 1) **TECHNICAL COMPETENCY** in the methods of calculus that will enable them to find limits, derivatives and integrals of vector-valued and multi-variable functions and to recognize the setting in which the result applies. (*Supports Mathematics Program Outcomes 1 and 5*)
- 2) **CONCEPTUAL UNDERSTANDING** of limits, continuity, differentiation and integration and the theorems that relate these topics as applied to vector-valued and multi-variable functions. Conceptual understanding will be developed by requiring students to view and understand these topics and their related theorems from numeric, geometric, algebraic and written/verbal perspectives. (**The Rule of Four**). (*Supports Mathematics Program Outcomes 1, 2, 4, 5, 6 and 7*)
- 3) **UTILITY** in the methods of calculus. Students will use calculus to solve applied problems from a variety of disciplines ranging from biology, economics, business, engineering, and the social sciences, but primarily focusing on applications from physics and mathematics. (*Outcomes 1, 2, 4, 5, 6 and 7*)

Assessment (How do or will students demonstrate achievement of each outcome? Please attach a copy of your assessment electronically.)

Students demonstrate achievement of each outcome by scores on calculus III problems from the GRE Mathematics Subject Exam.

Validation (What methods have you used or will you use to validate your assessment?)

The percent correct for HCC students for each problem is compared to the percent correct of a sample of GRE mathematics test examinees selected to represent all mathematics test examinees tested between July 2004 and June 2007.

Results (What do your assessment data show? If you have not yet assessed student achievement of your learning outcomes, when is assessment planned?)

Assessment Question	1	2	3	4	5*
Learning Outcomes	3	1	1, 2	1, 3	2
HCC mean	36%	21%	43%	43%	63%*
GRE mean	66%	39%	41%	28%	70%*
HCC mean minus GRE mean	-30%	-18%	+2%	+15%	-7%*

*Question 5 is a common question but is not taken from a GRE exam. 70% is used as a target standard score.

The scores indicate there is room for improvement in achieving all learning outcomes. Scores could be improved by more practice on problems that emphasize utility and conceptual understanding. However, the HCC students did score higher than the GRE examinees on question 3 and 4, which also relate to all learning outcomes. This is significant since the GRE examinees in general would have considerable more mathematical knowledge since for the most part they possess four year degrees, presumably in mathematics or in a mathematics related field. For this reason the GRE scores represent a target toward which instruction aspires. It is difficult to find sources so that data for calculus III can be validated. GRE exams seemed the best choice.

Follow-up (How have you used or how will you use the data to improve student learning?)

More practice on problems that emphasize utility and conceptual understanding. (see response to prior question)

Budget Justification (What resources are necessary to improve student learning?)

None at this time.