

Course Tag Reflection Exemplar
Scientific Inquiry & Research Skills

Leonid Kovalev, Ph.D.
Graham Leuschke, Ph.D.
MAT 296: Calculus II

Identify the course learning objectives in the syllabus that are clearly aligned to Scientific Inquiry & Research Skills and respective assignment(s).

At least four CLOs clearly align to Scientific Inquiry and Research Skills:

1. integrate trigonometric functions,
2. apply integration methods such as integration by parts and partial fraction decomposition,
3. solve problems involving volume, arc length, & elementary differential equations,
4. solve problems involving improper integrals & infinite limits of integration

All of them concern the concept of an integral, the central object of MAT 296. The goal is to find an aggregate quantity, such as the volume of a solid, based on partial data, such as the shape and size of the slices of that solid.

The first two CLOs emphasize the algorithmic aspects of the integration problem, which are much more involved than the anything students encounter in their first semester of calculus (reference: <https://xkcd.com/2117>). The third CLO covers some of the interpretations of integrals outside of mathematics: volume, area, length, mass, etc. The fourth one expands the notion of an integral in a seemingly abstract way, which is nonetheless important for applications, for example in theoretical physics.

Explain the connection between specific assignment(s) and Scientific Inquiry & Research Skills. At least 30% of the course grade must engage students in the selected competency for the course to be tagged.

Midterm Exam 1 (19%): students use the integration methods introduced at the beginning of the course

Midterm Exam 2 (19%): students find improper integrals, and apply the method of integration in applied contexts

Final Exam (19%) is cumulative and reinforces the concepts covered by the midterm exams.

At least 57% of the final grade relates to this competency.

Describe in detail the instructional strategies faculty use to intentionally teach Scientific Inquiry & Research Skills in the course.

As in other calculus courses, faculty give lectures and administer online assignments (WebAssign is currently used in MAT 296) which break the larger objectives into smaller tasks like integrate the square of a trigonometric function. Teaching assistants hold weekly meetings in small groups, engaging students in a discussion, demonstrating examples, and administering quizzes. Larger summative assessments are given in the exam form (in person). They ask the students to synthesize the atomic skills they practiced earlier into the solution of multi-step problems. Such tasks involve setting up a mathematical model matching a verbal description, which is a fundamental part of quantitative research.

Describe the feedback tool(s) faculty use to support students' competency development on Scientific Inquiry & Research Skills.

Online assignments (WebAssign) are used course-wide in MAT 296. They provide instant feedback to the students, who then have an opportunity to correct and resubmit their work. Exams are graded by a team including both faculty and teaching assistants; the students receive written feedback explaining the mistakes they made. Rubrics are used to ensure the consistency of grading within the team.