

Semester Reports For Math 471

1 Relevant Student Learning Outcomes (SLOs)

In discussion with the faculty, the undergraduate committee created the student learning outcomes for the pure and applied math majors. The following SLOs are pertinent to the course content in Math 471.

1. Use techniques from calculus to design analytical and numerical methods to solve applied problems, and understand the accuracy and limitations of the methods.
2. Understand simple differential equations models and their applicability.
3. Use numerical techniques, and judge their accuracy, for solving mathematical problems.
4. Communicate well, orally and in writing, in an applied mathematics context.

Math 471 offers several opportunities for creating homework assignments which assess student performance in these areas.

Outcome #1 and #3 can be assessed by asking students to implement an iterative method and discuss its convergence properties. Outcome #1 and #3 can also be assessed by asking students to derive and implement finite difference approximations to derivatives and discuss their accuracy and stability properties in the context of discretization of differential equations. Outcome #2 will be assessed in a homework assignment on numerical discretization of time dependent ordinary differential equations modeling the interaction of, for example, particles. Outcome #4 can be assessed using reports that the students hand, in-class presentations, and/or through student instructor interaction during the computer laboratory sessions in the course.

Every instructor for Math 471 is asked to complete a “Semester Report”, which provides data on the performance of these students in achieving these outcomes. Instructors will be asked to separate the results from different concentrations and majors. To that end, students should be asked to self-identify which major or concentration they have declared, perhaps with a question on the first exam or on a survey administered to the class.

Finally, instructors should ask students to self-assess their performance on these SLOs through questions on an electronically administered survey.

2 Rubrics

The purpose of the rubrics is to ensure that assessment occurs independently from the instructor's chosen grading scale. For example, some instructors may view that a student who gets 80-90% of the points to have given a "very good" solution while others may expect 100% credit to be rated at this level, using the "excellent" rating to distinguish exceptional solutions.

2.1 Rubric for SLO #1:

Use techniques from calculus to design analytical and numerical methods to solve applied problems, and understand the accuracy and limitations of the methods.

Excellent	Exemplary derivation of the numerical method, with full justification for each step and the logic of argument flows naturally. Choice of the approximation is well motivated and effective for the given problem. Mathematical and English language is highly articulate.
Very Good	Cogent derivation of the numerical method, with most key steps clearly justified. Choice of the approximation is effective for the given problem. Mathematical and English language is easily understandable.
Satisfactory	Comprehensible derivation of the numerical method, with justification for the essential steps. Choice of the approximation is effective for the given problem. Errors are relatively minor. Mathematical and English language is decipherable.
Questionable	Partial progress on the derivation of the numerical method, only some essential steps are justified. Some visible progress on selecting the approximation for the given problem. Mathematical and English language is incomplete.
Unacceptable	Poorly written the derivation of the numerical method, essential steps lack justification. Choice of the the approximation is unclear or is ineffective for the given problem. Errors are striking. Mathematical and English language is unclear.

2.2 Rubric for SLO #2:

Understand simple differential equations models and their applicability.

Excellent	Exemplary discussion which demonstrates full comprehension of the model. Student has a clear understanding of what the differential equations models. Mathematical and English language is highly articulate.
Very Good	Cogent discussion which demonstrates good comprehension of the model. Student has good understanding of what the differential equations models. Mathematical and English language is easily understandable.
Satisfactory	Understandable discussion which demonstrates reasonable comprehension of the model. The chosen strategy for approximation is recognizable and mostly effective. Student has an understanding of what the differential equations models. Errors are relatively minor. Mathematical and English language is decipherable.
Questionable	Incomplete discussion which demonstrates a partial comprehension of the model. The chosen strategy for the approximation has potential. Student indicates a partial understanding of what the differential equations models. Errors are significant. Mathematical and English language is incomplete.
Unacceptable	Poorly written discussion which demonstrates little or no comprehension of the model. The chosen strategy for the approximation is unclear and/or ineffective. Student does not demonstrate an understanding of what the differential equations models. Errors are striking. Mathematical and English language is unclear.

2.3 Rubric for SLO #3:

Use numerical techniques, and judge their accuracy, for solving mathematical problems.

Excellent	Exemplary use and implementation of the numerical method. Student has a complete understanding of the accuracy of the method. Mathematical and English language is highly articulate.
Very Good	Cogent use and implementation of the numerical method. Student has a good understanding of the accuracy of the method. Mathematical and English language is easily understandable.
Satisfactory	Comprehensible use and implementation of the numerical method. Student gives at least some indication of the accuracy of the method. Mathematical and English language is decipherable.
Questionable	Incomplete use and implementation of the numerical method. Student may show some comprehension of the accuracy of the method. Errors are significant. Mathematical and English language is incomplete.
Unacceptable	Poor use and implementation of the numerical method. Unclear whether or not the student understands the method. Errors are striking. Mathematical and English language is unclear.

2.4 Rubric for SLO #4:

Communicate well, orally and in writing, in an applied mathematics context.

Excellent	Exemplary reports where the mathematical and English language is highly articulate.
Very Good	Cogent reports where the mathematical and English language is easily understandable.
Satisfactory	Comprehensible reports where the mathematical and English language is decipherable.
Questionable	Incomplete reports where the mathematical and English language is incomplete.
Unacceptable	Poor reports where the mathematical and English language is unclear.