Semester Reports For Math 316

1 Relevant Student Learning Outcomes (SLOs)

In discussion with the faculty, the undergraduate committee created the student learning outcomes for the applied math majors. The following SLOs are pertinent to the course content in Math 316.

1. Effectively perform essential computations in linear algebra, including solving linear systems, computing the eigenvalues of a matrix, and determining linear independence.

2. Compute limits and derivatives using their definitions, and use the fundamental theorem of calculus to compute definite and indefinite integrals.

3. Understand simple differential equations models and their applicability.

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

In Math 316, student performance in these areas is assessed by regular graded homeworks, 2-3 mid-semester exams, and a final exam. Time permitting, short quizzes are sometimes given as well.

SLO 1 is assessed by asking students to write 2x2 systems of first order differential equations in matrix form, find the eigenvalues and eigenvectors of the matrix, write the solution to the system as a linear combination of fundamental solutions, and graph the resulting family of solutions in the plane.

SLO 2 is assessed by asking students to find exact solutions to differential equations that require finding definite integrals, or finding solutions formulated as integrals. Examples arise when aplying the method of separation of variables, the method of integrating factors, reduction of order and variation of parameters.

SLO 3 is assessed by asking students to find models for simple applications or to interpret all components present in a model. Applications students explore include springs and mechanical vibrations, mixing problems, single population models with or without a "harvest" component, and interaction between populations of two species.

SLO 4 is assessed based on the clarity of the presentation of the students work in exams.

Every instructor for Math 316 is asked to complete a "Semester Report", which provides data on the performance of the 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:

Effectively perform essential computations in linear algebra, including solving linear systems, computing the eigenvalues of a matrix, and determining linear independence.

SLO 1 is assessed by asking students to write 2x2 systems of first order differential equations in matrix form, find the eigenvalues and eigenvectors of the matrix, write the solution to the system as a linear combination of fundamental solutions, and graph the resulting family of solutions in the plane.

Excellent	Correct solution to a 2x2 linear system of equations, clearly showing all steps in a legible, neat, well-organized presentation, demonstrating full understanding of all steps taken. Graphical representation of solution curves is well labelled, clearly indicating type of equilibrium, showing several solution curves and the direction of increasing time. Mathematical and English language is highly articulate.
Very Good	Correct solution to a 2x2 linear system of equations, showing all steps in a cogent presentation, demonstrating full understanding of all steps taken. Graphical representation of solution curves is correct and complete. Mathematical and English language is easily understandable.
Satisfactory	Good presentation with most steps shown and minor algebra mistakes, but otherwise consistent work. Mathematical and English language is decipherable.
Questionable	Unclear presentation, algebra mistakes, incorrect results, outline of the argument is correct. Mathematical and English language is incomplete.
Unacceptable	Sloppy, unclear presentation, incorrect results, inconsistencies in the work. Mathematical and English language is unclear.

2.2 Rubric for SLO 2:

Compute limits and derivatives using their definitions, and use the fundamental theorem of calculus to compute definite and indefinite integrals.

SLO 2 is assessed by asking students to find exact solutions to differential equations that require finding definite integrals, or finding solutions formulated as integrals. Examples arise in the method of separation of variables, integrating factors, reduction of order and variation of parameters.

Excellent	Exemplary solutions to all integrals, including correct algebra, clearly shown well-organized work, correct form of solutions that can only be given in integral representation, correct description of basic properties of these solutions, such as unbounded behaviour near asymptotes, roots, local extrema. All results clearly justified. Mathematical and English language is highly articulate.
Very Good	Cogent solutions to all integrals, including correct algebra, clearly shown well-organized work, correct form of solutions that can only be given in integral representation, correct description of basic properties of these solutions, such as unbounded behaviour near asymptotes, roots, local extrema. Mathematical and English language is easily understandable.
Satisfactory	Understandable solution with minor algebra mistakes, or small errors and inconsistencies in properties of resulting functions. Mathematical and English language is decipherable.
Questionable	Major algebra mistakes, major inconsistent results, but student realizes inconsistencies, unclear writup. Mathematical and English language is incomplete.
Unacceptable	Inconsistent result, blatantly incorrect algebra, sloppy unclear writeup. Mathematical and English language is unclear.

2.3 Rubric for SLO 3:

Understand simple differential equations models and their applicability.

SLO 3 is assessed by asking students to find models for simple applications or to interpret all components present in a model. Applications students explore include springs and mechanical vibrations, mixing problems, single population models with or without a "harvest" component, and interaction between populations of two species.

Excellent	Exemplary discussion which demonstrates full comprehension of all terms in the model. Student has a clear understanding of what the differential equations models and can deduce properties of the solution based on values of the parameters in the model. Student explains contribution of each term using highly articulate Mathematical and English language.
Very Good	Cogent discussion which demonstrates good comprehension of the model. Student deduces correct properties of the solution based on values of the parameters in the model. Student explains contribution of each term using easily understandable Mathematical and English language.
Satisfactory	Understandable discussion which demonstrates reasonable comprehension of all terms in the model. Mathematical and English language used to describe the contribution is decipherable.
Questionable	Incomplete discussion which demonstrates a partial comprehension of the model. Student indicates a partial understanding of what the differential equations models, and of the properties of solutions as functions of parameters in the model. Mathematical and English language is incomplete.
Unacceptable	Poorly written discussion which demonstrates little or no comprehension of the model. Student does not demonstrate an understanding of what the differential equations models, and cannot deduce properties of solutions as a function of parameters in the model. Mathematical and English language is unclear.

2.4 Rubric for SLO 4:

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

SLO 4 is assessed based on the clarity of the presentation of the students work in exams.

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