

Note: This will be a private project: code that refers to PHY201 problems MUST NOT BE SHARED. All team members will have to sign a statement that they will adhere to these restrictions.

PHY 494 Final Project – The 201 Module

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Problem: PHY 201 is a required course at ASU for physics and astrophysics majors that can give many students a tough time. While a lot of the course focuses on proofs and more abstract examples, there are also many concrete problems, especially in the first half of the semester. The topics of these problems range over a variety of different mathematical concepts including:

- Complex Arithmetic
- First Order Differential Equations
- Second Order Differential Equations
- Vector Algebra and Matrices
- Orthogonal Functions and Fourier Series
- The One Dimensional Wave Equation

Many of these concepts also hold several sub-sections. For example Complex Arithmetic consists of complex addition/subtraction, multiplication/division, inverses and roots etc. FODE houses many types of differential equations such as Scale Invariant, Exact and Integrating Factors. These problems can be very difficult and the course focuses on grading the student based on their work and reasoning, not necessarily their final answers. Therefore this module will be meant to aid students in checking their final answers, which will solidify their understanding of the material without allowing them to cheat.

Approach: First I will say that due to my limited knowledge of Python programming I am not ever completely sure if all of these types of problems can be coded. However, the task sounds really fun to attempt and I feel like that is the point of this project, to code something useful and interesting to us. Now for the technical aspects of this project the approach needs to be mentioned. I expect the Complex Arithmetic to be pretty trivial in coding. Ultimately I will just need a few functions that can do things such as the complex conjugates, complex inverses and complex to polar form. For the differential equations I think only one function is needed for each, but those functions will contain for loops that analyze the structure of the inputs and produce the appropriate output based on the differential equation type. The code for the matrices and vectors also should not be too difficult as we have already dealt with these in class. However the code will need to utilize algorithms that iterate through the input arrays so that any size matrix or vector can be an input. I am mostly concerned with the coding that will be needed for the last two sections shown above. However my goal is to code everything possible and if certain concepts cannot be coded they will be skipped.

Objectives: This project aims to satisfy several objectives:

- Transfer all possible mathematical processes from the course into functioning code
- Solve a wide array of problems from HW, requiring the code to be written generally
- When implemented on the PHY201 exam, give mostly correct answers for a good grade
- Be written as simply as possible to teach 201 students math and code simultaneously
- If allowed, be licensed and sold to 201 students as a course supplement for a profit (only joking, unless of course that would be allowed, then totally serious)