The goal of the lab exam is to assess students' SageMath programming skills, requiring minimal familiarity with the specific mathematical ideas taught in LS30A lectures. A student who has done the labs without copying the answers from others should be able to do well on the exam without substantial extra preparation.

You will take the lab exam during the first hour of your week 9 section. You will be able to use only a new worksheet in CoCalc, the functionality of CoCalc\(^1\), and a “cheatsheet” on both sides of an 8.5x11 page that you prepare and bring to complete exercises similar to those on the following pages. Each student will be assigned 4 exercises covering all or most of the topics below. You will use a new project in CoCalc with your name and the words “LAB EXAM” in the title.

There are multiple ways to solve many of these problems, so we will give credit (including partial credit) based on how well your code solves the problem given. You should also use good programming style, such as descriptive variable/function names and axes labels. Comments are only required if specifically requested, but feel free to use them whenever you want. If you’re not sure how to code something, use comments to describe what the code should do and code as much as you can to earn partial credit.

We provide two practice exams on the following pages. We have already posted these practice exams on CoCalc using the format you will see when you take the lab exam. We will post example solutions to the practice exams by early week 9.

To prepare for the lab exam, we recommend (in no particular order):

- Doing the practice exams
- Doing problems relating to the topics below in the labs and be able to explain what each line does
- Doing problems in the programming review sessions (TBA)
- Experimenting with the examples to clarify what each line and command does
- Discussing any remaining questions with your classmates, TAs, and LAs
- Preparing your own “cheat sheet” of Sage commands and syntax with the format described above.

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\(^1\) This includes CoCalc’s built-in help, such as “desolve_odeint?” (which display documentation for a command or function like desolve_odeint), the top menus (which create sample code for many commands), and error messages.
Topics:

- Variables
- Lists, For Loops and Iteration (including `len` and `srange`)
- Plotting (including `plot`, `list_plot`, `plot_vector_field` and options `color`, `plotjoined`, `axes_labels`, `size`, `legend_label`)
- Simulation with `desolve_odeint` (example code will be provided as in practice exams)
- Defining and Using Functions (both mathematical and Python functions)
- If/Else Statements (including `and`, `or`, `==`, `!=`, `>`, `<`, `<=`, `>=`)
- Debugging & Common Errors

Topics not covered on the lab exam:

- Interactives
- Animations
- While Loops
- Euler’s method