Note: This is the syllabus I used for MATH 205 in Fall 2017. It should not be regarded as a “master syllabus”, as the choice of course content will vary quite a bit from instructor to instructor in these Math Labs. However, what I expect will be roughly the same in all Math Labs are the following course goals:

(1) Help students gain experience in both talking and writing about mathematics.
(2) Get students away from the idea that math is about learning algorithms and then showing that you can carry them out. We want to help students get on the path of asking questions about why things work, experimenting, and searching for explanations.
(3) Give students some exposure to mathematics outside of the standard “road to calculus”.

A complete resource for all the reading and writing assignments I assigned, and all the worksheets I used, is available here:

http://pages.uoregon.edu/ddugger/ma205.html

Title: Foundations MathLab

Instructor: Daniel Dugger

Contact Info: 215 Fenton Hall, 346-8402, ddugger@uoregon.edu (also sometimes available in 205 Fenton Hall inside the main math office)

General information: 2 credits; class meets each Monday and Wednesday from 5–5:50pm in 44 Columbia.

Prerequisites: None.

Short course description: Exploratory course in mathematics. Course focuses on techniques of mathematical exploration and discovery, the language of mathematics, and foundational issues. Topics from set theory and mathematical logic.

Long course description: A “set” is the mathematical term for a collection of objects—picture a bag with a bunch of objects in it. It seems to be a very simple concept, but in the nineteenth and early twentieth centuries people realized that one can build up almost all of mathematics by just starting with the theory of sets. Functions and numbers are all examples of special kinds of sets! People thinking about infinite sets also came up with some very, very strange realizations that were quite shocking—and will shock you when you learn about them.
Originally, people hoped that one could build all of mathematics from the theory of sets. This looked possible for a while, until Gödel stunned everyone by proving that this is not possible. In fact, he proved that it is not possible to reduce all of mathematics to a finite set of basic ideas. This is his famous Incompleteness Theorem.

In this course we will do a survey of set theory and mathematical logic. We won’t delve very deeply, but we will cover a wide spectrum of ideas.

**Learning Outcomes:** The goal of the MathLabs is to help students make the transition from the kind of “procedure-driven” mathematics that they see in K-12 education (and that to some extent continues in lower-division college courses) to the more creative engagement with mathematics that is required for upper-division math courses.

- Students will continue the development of the mathematical skills of trying examples, looking for patterns, and making/testing/modifying conjectures.
- Students will continue the development of the mathematical skills of explaining their reasoning to others, and in forming judgments regarding whether an explanation is adequate or not.
- Students will continue the development of the skill of critically reading an account of mathematics.
- Students will be able to speak the language of set theory and mathematical logic at a basic level, and will be able to discuss the main constructions and paradoxes.

Class discussions and in-class worksheets, weekly writings, lab “write-ups”, and a final portfolio will provide students with opportunities to demonstrate the level of their abilities relative to the above learning outcomes.

**Organization of the course:** Each week there are two class sessions. The Monday session will focus on “Discussion” (usually from a reading) and the Wednesday session will focus on “Exercises”.

**Discussion Session (Monday):**
There will be an assigned reading (usually posted on Canvas), and at the beginning of class you will have to hand in a short piece of writing based on the text. Give some examples of the concepts you learned, list any questions that occurred to you, and also give any general thoughts you had about the reading. Usually one or two paragraphs is sufficient for this.

During this session we will discuss the reading, and perhaps work on an in-class activity surrounding a chosen math problem. This activity will lead to some questions that you will think about and explore a bit on your own before the next session.

**Exercise Session (Wednesday):**
This session will focus on how you explored, as your homework, the problems introduced in the last session. What did you try? What did you find? Did you make any conjectures? Did you find any explanations? Sometimes you might have to hand in a page or two of handwritten notes describing what you did, or showing
some work. We will also spend time on in-class worksheets that expand on the ideas that you thought about for your homework.

**Attendance:** Attendance is very important in this course. I will take attendance during each class, and this will contribute to your final point count in the course.

**Assessment:** Points for this course are awarded according to the following scheme:

- **Attendance** 30 (1.5 points per class session)
- **Weekly writing** 20 (two points per week)
- **Portfolio Drafts** 24 (eight points each)
- **Final Portfolio** 26

This course is offered as P/N only, with 80 points out of 100 being a passing grade. Work must be handed in on time, and must be in a reasonable state of completion. Mistakes can always be corrected later in the course. In this course, the only time you will be penalized for “being wrong” is on the final portfolio.

**Due dates:**

- Weekly writing is due every Monday, at the beginning of class.
- Portfolio drafts are due October 11, November 1, and November 22. The October 11 draft must contain at least one “write-up”, the November 1 draft must contain at least three “write-ups”, and the November 22 draft must contain at least four “write-ups”. (Note that the work is cumulative, so that the November 1 draft only involves two additional write-ups beyond what was already handed in on October 1).

  The Portfolios will (mostly) be written in LaTeX, which is the main software used for mathematical typesetting. We will learn how to use this software as the course progresses.

**NOTE:** Late work is not accepted except in extreme circumstances as determined by the instructor.

**Workload:** A student should expect to spend 60 hours on this course during the term, with the work divided up roughly as follows:

- **Class sessions** 2 hours per week
- **Reading** 1 hour per week
- **Homework** 3 hours per week.

The “Homework” portion of the workload includes three things: weekly writings on the readings, thinking about the exercises, and five “write-ups” that address topics from our exercise sessions. For the latter, you will choose five of the worksheets we worked on during the quarter and you will give a complete write-up of the solutions. These write-ups should explain the problem, things you tried, any conjectures that
arose, and explanations for the conjectures that you know how to resolve. In most
cases this will just be a page or two per write-up.

Throughout the course you will maintain a portfolio of your work. The portfolio will
contain the things you handed in each week, together with the five write-ups. After
getting feedback on your work, you might choose to revise some of it before submitting
your final portfolio at the end of the course. This will give you the opportunity to
correct mistakes and learn from them, before getting your final grade.

**Learning Environment:** The University of Oregon strives for inclusive learning
environments. Please notify me if the instruction or design of this course results
in disability-related barriers to your participation. You are also encouraged
to contact the Accessible Education Center in 164 Oregon Hall at 541-346-1155 or
uoaec@uoregon.edu.

**Academic Conduct:** The code of student conduct and community standards is at
dos.uoregon.edu/conduct. In this course, it is appropriate to help each other on
homework as long as the work you are submitting is your own and you understand
it.