Math 199–Math and the Creative Process:
A Participatory Exploration of Number Theory
Course Information

Professor	Ellen Eischen (eeischen@uoregon.edu)
Office Hours	Monday 1:30-2:30, Friday 2-3 (through our class's Zoom link)

Target Audience This interactive course, which counts as two math labs toward the math major, is open to all undergraduates who are interested in learning pure mathematics. Enrolled students should be interested in engaging in exercises to develop skills not only in number theory, but also for exploring, collaborating, and communicating.

Course Prerequisites Students need to be completely comfortable with pre-college math, including fractions, exponents, basic trigonometry, and variables.

Learning Goals This course will immerse students in creative, abstract problem-solving, with an emphasis on developing skills to explore and communicate about pure mathematics. Through collaborative exercises and computational projects, students will learn to make conjectures, formulate questions, and discover patterns, with a focus on topics in number theory. This course will focus on the process of doing mathematics, while also jumpstarting students' exploration of topics arising in research in number theory, e.g. factorization, prime numbers, and roots of polynomials. The course will culminate in a final project through which students will produce visualizations that will be exhibited broadly to non-experts, including at the Jordan Schnitzer Museum of Art.

Students in this course can expect to be pushed out of their comfort zones and approach mathematics in new ways. They should be prepared to participate in active exercises (e.g. adapted from the arts, including improvisational theater exercises focused on developing communication, observation, and collaboration skills). Except to fill in necessary background, this course will not be lecture-based and instead will require students to be active during class. Skills developed in this course will be useful in any further mathematical studies, both coursework and research.

Course Requirements Students are expected to engage actively in all components of the class.

Course Resources There is a wealth of information on Canvas. For example, the Pages section of Canvas has an extensive library reserve list and links to other resources. In addition, we will have two guest experts:

Heather Barnes (`https://www.secondcity.com/people/heather-barnes+`) will lead workshops on preparing our blurbs for the museum on Wednesday of Week 9 and Monday of Week 10.

Sherri Jones (Museum Education Program Coordinator at the Jordan Schnitzer Museum of Art) will lead a session in *Visual Thinking Strategies* on Wednesday of Week 5.

Grading Policy:
- **Weekly discussion board assignments 10%**
  Each week you will write a few sentences in response to a prompt, and you will also respond to at least one of your classmates. Each assignment is worth 5 points (3 for your post and 2 for your response). You can get extra credit (or make up points) in this category by posting extra responses or through other helpful activity on the message board (such as answering classmates questions).
- **Class participation (including class reports) 20%**
  Students are expected to participate in class (barring issues with technology, etc in the remote format). In addition, for each of the 16 class meetings (aside from exam week) that we do not have a guest, one student will be assigned to post (in the Pages section of Canvas) a class report, worth 4 points, summarizing what we did in class that day. It will serve as a resource to the class, and other students are encouraged to edit each report if any information is missing or inaccurate. In addition, participating regularly in the in-class exercises and discussions will result in 16 class participation points.
- **Exercises and Investigations sets (and peer feedback) 35%**
  In Weeks 2, 4, 6, 8, and 10, you will submit your responses to an "Exercises and Investigations" set. These are designed both to reinforce mathematical concepts and to lead you to think creatively about problems. You should clearly explain what you tried and how approached each item, even if you do not get to a final solution. Also, it often happens that you gain new insight into an old problem as time goes on and you are thinking about things from a new angle. So, as weeks go on, you may choose to go back and re-explore old problems in place of new ones.
  Each is worth 8 points, broken down as follows:
    - Your assignment will be graded $\checkmark$, $\checkmark+$, $\checkmark-$ (worth, $4, 5, 2$ points, respectively).
    - Following a rubric provided to students, you will anonymously provide feedback to two peers (each worth 2 points)
  (So a $\checkmark$ is sufficient to get full credit. The grades with $+$ or $-$ will be given only for work that is exceptional or substantially incomplete, respectively.)
- **Museum Project assignments 35%**
  In Weeks 1, 3, 5, 7, 9, and Final Exam Week, there will be assignments tied to the exhibit we are producing for the Jordan Schnitzer Museum of Art.
  Week 1: Complete the survey about your background and interests. This will help me propose appropriate material to get you started. (3%)
  Week 3: Formation of collaborative project teams. (4%)
  Week 5: Detailed progress report and plans for completion of visualization component. (6%)
  Week 7: Visualization component due. (10%)
  Week 9: Mathematical description due (6%), plus museum blurb exercise (4%)...final versions of both due in Final Exam Week
  Final Exam Week: During our final exam period (Wed 10:15-12:15), each project team will give an approximately 5-minute presentation (2%) about their project, answer questions, and provide questions/feedback other groups. Final descriptions (including museum blurb) also due by 10 am Thursday of exam week (in case you want to take into account feedback from your presentation).
- **Math journal 0%**
  I will never collect this (hence, can't give you points for it), but I will expect you to keep a journal (hand-written or typed) in which you write daily or nearly daily about, for example, the math you thought about that day, a point you are stuck on, something you found interesting, what's working or not working for you as you adapt to learning in a remote setting, math images you liked, or whatever seems worth recording that

day. More generally, such a journal can also help you find ways to work effectively in the new remote format. This is simply a tool to help you.

Course Policies: Students are expected to participate actively and supportively. Also:
- Expect to spend at least 8 hours per week on this course, outside of class.
- Any student needing accommodation for a disability is required to make arrangements through AEC as early as possible in the term, preferably within the first two weeks.

Honesty: Students are encouraged to discuss the course material with each other and to work on the assigned problems together. Unless explicitly instructed otherwise, though, each student must submit his or her own assignment. The only way to master the material is by working through exercises (including struggle and mistakes along the way). Simply copying someone else's work is not a shortcut to mastery. Future assignments completed by a student who has submitted plagiarized work will be neither accepted nor graded.

Dishonesty, in particular plagiarism, will result in a course grade of F and be reported directly to the university, either during the quarter or at the end of the term. This policy is non-negotiable, and I will not meet with you to discuss alternate consequences. Failure to listen as we cover this policy in class, failure to read this document, and failure to understand the university's Student Conduct Code will not be viewed as mitigating factors.

On the importance of having already fulfilled the prerequisites: I will not meet with students individually or in office hours to provide tutoring on pre-college mathematics that is prerequisite knowledge for this class. In particular, if you do not know basics of fractions, exponents, trigonometry (sin, cos, tan, etc.), or variables (like in high school algebra), then do not take this class. In addition to traditional courses and textbooks, there are several excellent online resources (such as `https://www.khanacademy.org`) covering such topics.

Changes: In the event of unforeseen circumstances (such as those caused by the pandemic or remote learning setting), the professor reserves the right to make changes to the syllabus. If such changes must be made, students will be notified as soon as possible.

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Weekly Plan

Last updated May 25, 2020. To be updated as necessary, as the quarter progresses.

Week 1

Monday (3/30): Introduction to this course
Wednesday (4/1): Complex plane, prime numbers
Due this week: Message board response due MONDAY. Survey due FRIDAY.

Week 2

Monday (4/6): Polynomials, complex plane, prime numbers
Wednesday (4/8): Overview of some possible museum project topics
Due this week: Message board response due MONDAY. Exercises and Investigations set due WEDNESDAY, peer evaluations due FRIDAY.

Week 3

Monday (4/13): Topics in number theory
Wednesday (4/15): Topics in number theory, time to discuss project team formation
Due this week: Message board response due MONDAY. Personal project preferences/assessments due MONDAY, project teams formations due FRIDAY.

Week 4

Monday (4/20): Topics in number theory, working on visualization projects
Wednesday (4/22): Topics in number theory, working on visualization projects
Due this week: Message board response due MONDAY. Exercises and Investigations set due WEDNESDAY, peer evaluations due FRIDAY.

Week 5

Monday (4/27): Topics in number theory
Wednesday (4/29): Visual Thinking Strategies workshop with Sherri Jones (Museum Education Program Coordinator at the Jordan Schnitzer Museum of Art)
Due this week: Message board response due MONDAY. Detailed progress report and plans for completion of visualization component due as draft on MONDAY and in revised form on FRIDAY.

Week 6

Monday (5/4): Topics in number theory, working on visualization projects
Wednesday (5/6): Topics in number theory, working on visualization projects
Due this week: Message board response due MONDAY. Exercises and Investigations set due WEDNESDAY, peer evaluations due FRIDAY.

Week 7

Monday (5/11): Topics in number theory
Wednesday (5/13): Going over feedback and final details on visualization projects
Due this week: Message board response due MONDAY. Visualization component due MONDAY, with option to take feedback into account and submit revised version in *final form*[1] FRIDAY.

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[1]These visualizations will be sent to the printer to produce the pieces for the museum exhibit.

Week 8

Monday (5/18): Topics in number theory
Wednesday (5/20): Topics in number theory
Due this week: Message board response due MONDAY. Exercises and Investigations set due WEDNESDAY, peer evaluations due FRIDAY.

Week 9

Monday (5/25): Memorial Day (NO CLASS)
Wednesday (5/27): Communicating Math Workshop 1 with Heather Barnes (`https://www.secondcity.com/people/heather-barnes+`)
Due this week: Message board response due MONDAY. Mathematical description due TUESDAY, Museum blurb exercise due WEDNESDAY (your intro) and Friday (your responses to peers).

Week 10

Monday (6/1): Communicating Math Workshop 2 with Heather Barnes
Wednesday (6/3): TBA
Due this week: Message board response due MONDAY. Exercises and Investigations set due WEDNESDAY, peer evaluations due FRIDAY.

Final Exam Week

Wednesday (6/10): During our final exam period (10:15-12:15, as assigned by the registrar), each project team will give an approximately 5-minute presentation about their project, answer questions, and provide questions/feedback other groups. Final descriptions (including museum blurb) also due at this time.

July 15–August 2

Our exhibit at the Jordan Schnitzer Museum of Art.

July 20-24, 2020

A K–12 STEAM camp takes place at the Jordan Schnitzer Museum of Art.

Someday (Fall 2020? Spring 2021?)

Someday, when the pandemic is over and the need to social distance is but a memory, I will organize an in-person gathering on campus. We will get to see the print-outs of our work in person, and Heather Barnes will visit from Chicago to lead us in improv exercises/games, with a view toward communicating and collaborating in mathematics and science.