



Problem Solving in Mathematics

Math 605 – 3 Credit Hours – Spring 2022
1/10/2022 - 5/6/2022

Instructor: Dr. Adrian Gentle
Contact Info: apgentle@usi.edu (preferred)
Office Hours: 1-2pm MTRF via [Zoom](#). Also by appointment.
Time Zone: All times in this class are in US Central time.
Location: Online

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“It’s not that I’m so smart, it’s just that I stay with problems longer” - Albert Einstein

Course Description: The theory and practice of mathematical problem-solving. The course considers problems in many areas of mathematics, including arithmetic, algebra, geometry and number theory. This is a content course for teachers of secondary mathematics.

Prerequisite: 24 hours of mathematics including calculus.

Course Philosophy: This course will actively engage students in the process of doing mathematics through problem solving. The goal is to equip students with the “mental operations... useful for the solution of problems” (Polya, p.2), through which they will “acquire something more important than the knowledge of any particular mathematical fact” (Polya, p.5). Along the way students will develop a deeper appreciation of the true nature of mathematics as an active, creative, human endeavor.

Course Learning Outcomes: Students who complete this course will be able to:

- Describe and apply problem-solving heuristics;
- Describe and apply mathematical problem-solving tactics;
- Explore problems mathematically, formulate conjectures and pose problems;
- Monitor and adapt strategy during problem solving;
- Communicate mathematical ideas with clarity and precision;
- Synthesize ideas and revise problem solving through collaboration;
- Recognize, analyze and relate instances of productive struggle and failure;
- Analyze and synthesize research on student learning in relation to problem solving and problem posing.

Required Texts: The following texts will be used throughout the course:

- *How to Solve It* by G. Polya, Expanded Princeton Science Library Edition, 2004.
- *Thinking Mathematically* by J. Mason, L. Burton and K. Stacey, 2nd edition, Pearson, 2010.

Participation & Engagement: You are responsible for your education, and as such you are expected to check-in with the course regularly, be involved with discussions, and complete all assignments and activities on time. There are weekly due dates. Communications and interactions with other students and the professor should follow common social standards for respect and courtesy. Please consult the [Netiquette](#)

[Guidelines](#) for more information.

Office Hours and Seeking Help: The best way to seek help is to email your instructor. Some issues or questions can be directly addressed by email, or Zoom virtual office hours. You can expect emails to be answered within one business day.

Course Structure: The course is split into three broad streams, each of which spans the semester and involves weekly assignments.

Lectures. Weekly video lectures will introduce many of the basic ideas, heuristics and problem-solving strategies. Each lecture will be accompanied by a short lecture problem set, which is designed to flow directly from the ideas in the lectures. The challenge problems (see below) are not so directly connected to the weekly lecture, but the problem solving heuristics and tactics are still very relevant.

Challenge Problems. The core problem-solving activity in the course is your work on the challenge problems. These are “true” problems that are unlikely to be solvable without significant exploration and reflection. At any time you should be working on several problems, and your focus may shift as you make progress on some problems, while feeling stuck on others. By the end of the semester you must demonstrate sustained effort on these problems, as documented by weekly status reports, presentations, and engagement with the discussion forums.

Readings. Weekly reading assignments will begin with problem solving heuristics and strategies, drawn from the texts, and then explore the literature on problem solving. We will examine the effectiveness of the heuristics, consider metacognition and mathematical affect, problem posing and its relation to problem solving, problem-solving in the classroom, and the importance of genuine inquiry. There will be weekly assignments that ask you to reflect on the readings.

Assessments: New course material will be made available each week, and will include a short online lecture. In general, the weekly assessments will be a combination of:

- A problem set based on that week’s lecture;
- A status report on your ongoing work on the challenge problems;
- Either a presentation of your progress on a challenge problem – via a VoiceThread video – or significant collaboration and discussion in response to other students’ presentations;
- Discussion posts that highlight experiences of productive struggle or failure;
- A response to your assigned readings from the textbooks and/or scholarly articles.

Each week’s material will be released the preceding weekend (12:01am on Saturday morning) and **all assignments are due at 11:59pm on the Monday a little over a week later**. Assessments will be graded by specific rubrics, all of which are posted on BlackBoard (click on the specific assignment heading and select “View Rubric”). Assignments must be submitted in PDF format; see Technical Help on BlackBoard for assistance. Work that does not follow the assignment guidelines will earn zero credit. Specific assignment dates can be found in the Course Calendar on Blackboard. Assignments and tests will generally be graded and returned within one week of submission.

Midterm Exam: A midterm exam will cover heuristics and problem solving strategies, together with ideas from the assigned readings. Aspects of the challenge problems may also be covered. Details will be announced a week before the exam. See the Course Calendar for the schedule.

Problem Portfolio: At the end of semester you will submit a problem portfolio consisting of six completed challenge problems, and include a reflection on your progress and experience for each problem. Grades will be assigned by a rubric which considers the number, difficulty, correctness and completeness of the solution, as well as the quality of the reflection.

Grading: The final grade will be based on the introductory video (1%), attendance at initial Zoom meeting (1%), reading responses (10%), weekly lecture problems (15%), challenge problem status reports (5%), presentation of challenge problems (10%), collaboration with colleagues (10%), reflections on productive struggle & failure (5%), mid-term exam (online 10% and take-home 10%), the problem portfolio (15%) and final problem presentation (4%) and reflection (4%). Grading rubrics for each assignment may be found on BlackBoard. The cut-offs for the final letter grade are as follows:

A: 90% B: 80% C: 70% F: Below 70%.

Academic Integrity: Students are expected to maintain complete honesty and integrity both in and out of the classroom. In particular, you are expected to engage honestly with the problems in this course. **You may not consult resources outside of this course, including textbooks or solutions manuals, online materials, other professors, or students who are not in our class.** You are encouraged to talk to other students in our class or consult with me. Suspected cases of academic dishonesty will earn zero for the assessment and be referred to the [Dean of Students](#).

Late Work: You are expected to complete all assigned work in a timely manner. Plan ahead and submit your work early to avoid problems; technical problems are not an excuse. Late work will lose 25% of the maximum possible grade per day. Late work includes unreadable, unintelligible or inaccessible content, and material that does not follow the guidelines of the assignment. Details about specific assignments and due dates can be found on BlackBoard and in the Course Calendar.

Technical Requirements & Skills: You must have a reliable computer with a modern operating system and web browser, a high-speed internet connection, and have access to a webcam and microphone. See the [Office of Online Learning](#) for a full list of system requirements for online courses. Completing the course will require that you can

- navigate BlackBoard and upload documents;
- read and create PDF files (for example, using Adobe Acrobat Reader or MS Word);
- read and post comments in the online discussion boards;
- create VoiceThread presentations and upload them to BlackBoard;
- use the [Zoom video-conferencing software](#).

There is additional help on some of these under Technical Skills on BlackBoard, and the [Office of Online Learning](#) has more information on requirements for online courses, and accessing software.

Technical Support: There are several tutorials under the *Technical Help* link within our BlackBoard course for the specific tasks required for this course. The [Office of Online Learning](#) also has tutorials and other information, and you can also call upon the following technical support.

- **Help Desk.** For general technology assistance, please contact the Help Desk at (812) 465-1080 or send an email to it@usi.edu. More information is available at the [Help Desk website](#).
- **Blackboard.** Information is available in the [Blackboard FAQ](#). The Help Desk can also provide support during normal USI business hours (8am-4:30pm, Monday-Friday) at (812) 465-1080.

- **VoiceThread Support.** You should begin by reviewing the Technical Help link within the course, and the [VoiceThread tutorials](#). If you have other technical issues with VoiceThread, please contact Online Learning at (812) 228-5124 or send an email to online.support@usi.edu.
- **Zoom & Web Meeting Support.** For issues with Zoom, please review the information maintained by the [Office of Online Learning](#), who can also be contacted at (812) 228-5124 or by email at online.support@usi.edu.

Privacy Policies & Accessibility Statements: The [Office of Online Learning](#) maintains links to the privacy policies and accessibility statements for the various course technologies.

Withdrawal & Incomplete Policy: It is your responsibility to officially drop or withdraw before the deadline. Please refer to the [USI Academic Calendar](#) for specific dates. Under special circumstances, students may petition for an incomplete grade. However, it is up to the course instructor to decide if an incomplete will be granted. Students receiving an incomplete grade will need to complete all course requirements within one year to avoid an “F” grade.

Sexual Assault and Gender Violence Policy: USI does not tolerate acts of sexual misconduct, including sexual harassment and all forms of sexual violence. If you have experienced sexual misconduct, or know someone who has, the University can help. It is important to know that federal regulations and University policy require faculty to promptly report incidences of potential sexual misconduct known to them to the Title IX Coordinator, at 812-464-1703 or cnlynn@usi.edu, to ensure that appropriate measures are taken and resources are made available. The University will work with you to protect your privacy by sharing information with only those who need to know to ensure we can respond and assist. If you are seeking help and would like to speak to someone confidentially, you can make an appointment with a counselor in the University Counseling Center. More information about sexual violence, including campus and community resources, is available through the [Title IX Office](#).

Disability Resources: If you have a disability that may impact on your work in this class, please contact [Disability Resources](#) at 812-464-1961 or usi1disres@usi.edu as soon as possible. Students who are approved for accommodations by Disability Resources should request that their accommodation letter be sent directly to online instructors. Due to the nature of online courses, some accommodations approved for on campus courses may not apply. Students who receive an accommodation letter from Disability Resources are encouraged to discuss the accommodations with their professors before or during the first week of the semester.

Syllabus Change Policy: This syllabus is a guide to the course and is subject to change with reasonable advanced notice.