MATH 385 - TOPICS IN MATHEMATICS
PROBLEM-SOLVING STRATEGIES
FALL 2025

TTH 10:00 - 11:15 AM
TBA

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Office Hours: TBA
Prerequisites: MATH-250 or equivalent courses
Website: TBA
Textbooks: TBA

Course synopsis: One of the key skills for anyone engaged in fields such as programming and mathematics is the ability to solve challenging problems. In most mathematics courses such as Calculus, the majority of problems follow standard solution algorithms and require a minimal set of ideas. Unfortunately, within the framework of such courses, instructors are often reluctant to challenge students with difficult problems. However, if you are interested in mathematics — especially if you see it as your major, a potential career path, or even if you wish to participate in mathematical or coding competitions — it is crucial to develop strong problem-solving skills.

As is often the case, the only time-tested approach to mastering this skill is to tackle new mathematical problems. The goal of this course is to introduce and practice with a wide range of ideas, techniques, and methods that can aid in this endeavor. As the name of this course suggests, there will be a significant emphasis on problem-solving practice. Some of these problems will be taken directly from competitions such as PUTNAM link or the International Mathematical Olympiads link. Other problems might serve as lemmas in a research paper. Our aim is to 'merge' these two approaches, the competitive and the exploratory.

At the beginning of the course, we will delve into classical ideas that you may already be familiar with from other courses, such as MATH-250. We will then apply these methods to specific topics, as well as ideas and tricks characteristic of these topics. A tentative list of topics covered in this course includes:

- Induction
- Double counting
- Pigeonhole principle
- Invariance principle
- Extremal principal
- Analysis
- Inequalities
- Linear algebra
- Number theory
- Polynomials
- Probability
- Combinatorics and graph theory

Grading. TBA

Homework. There will be many problems.

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