Topics are subject to change.

Number Theory and Quadratic Forms. Which integers can be written as a sum of two squares? We'll use this question as a starting point to explore some fascinating topics in algebra and number theory.

Pick's Theorem. What is the area of a polygon whose vertices are all at integer-valued points? We'll derive a complete answer to this question and explore some extensions to other shapes and higher dimensions.

Counting Partitions. How many ways are there to divide a set of n objects into subsets of different sizes? For example, for n=5, there are seven: 5, 4+1, 3+2, 3+1+1, 2+2+1, 2+1+1+1, and 1+1+1+1+1. This problem is actually unsolved! But by exploring it we'll find some intriguing patterns and learn techniques from combinatorics that solve a wide array of similar problems.

Generalizing the Quadratic Formula. Can the quadratic formula be generalized to higher-degree polynomials? The answer is surprising: it can for a while, but the method stops working once the degree gets too high.

Continued Fractions. How can you approximate a real number by a rational with as small a denominator as possible? While you're probably familiar with approximating real numbers with decimal expansions, there is another, much less famous way to approximate reals with rationals that's much better suited to this problem.

Hyperbolic Geometry. What does plane geometry look like if we drop Euclid's most complicated axiom? We'll explore a bizarre version of the plane where a pentagon can have five right angles and parallel lines grow further apart as they run along, and say a bit about the strange and controversial role this geometry had in the history of mathematics.