One of the most important theorems in mathematics is the fundamental theorem of algebra, and degree is a central concept in the statement. In this talk, we explore the theory of degree on Riemann surfaces by developing a step-by-step example with $1/z$ on the Riemann sphere. We then state the theorem that degree is well-defined for compact Riemann surfaces. We explain what a Riemann surface is, at least intuitively, on the way. We also take a look at pretty Riemann surface pictures.

Yuqing Liu
In a 1640 letter to Mercentez, Fermat characterized which primes are of the forms $x^2 + y^2$, $x^2 + 2y^2$, $x^2 + 3y^2$ with integer $x, y$. It then took 300 years and the work of many mathematicians to answer the innocuous question “Which primes are of the form $x^2 + ny^2$?” for any positive integer $n$. In the process, plenty of deep mathematical tools were developed: the initial attempts using quadratic reciprocity and quadratic forms were soon generalized to cubic and biquadratic reciprocity, and finally class field theory, which gave a complete answer to the question.

Zihong Yi
How are equivalent coloring and inequivalent coloring defined? Is there a general way to count them? In this talk, we first introduce the idea of a group acting on the coloring of a finite set and orbit-stabilizer theorem. Then, we transition to Burnside’s lemma. With the help of Burnside’s lemma, we introduce Polya’s theorem to count specific inequivalent colorings. At the end, we discuss other applications of Polya’s theorem besides coloring problems.

Xiaoqi Peng
In this talk, we discuss the winning strategy for Angel and Devil playing on a chess board according to certain rules. If Angel of power $n$ can hop onto any grid within distance $n$ except for those where the Devil has previously occupied, can she keep moving forever? We prove Angel can win with power 2 or more, while Angel of power 1 can be trapped by a clever Devil. We also cover interesting strategies and variations of this game.