

There are three parts to the course: Number Theory -- Cryptoclub -- Problem solving  
Number Theory contains many topics that can be used to understand encryption techniques. Crypto Club activities provide examples of using Number theory in the real world and an interesting application to use with middle school students.

**Number Theory** is the study of integers (no fractions or irrational numbers!) and their properties relative to the operations of addition, subtraction, multiplication, and division. The topics of number theory that we cover are using different bases, arithmetic progressions, combination charts, factoring and prime numbers, lcm and gcd, solving Diophantine equations, modular arithmetic, solving congruence equations, geometric sequences, and powers of numbers in modular arithmetic.

In **The Cryptoclub** we will cover Caesar ciphers, Vigenère ciphers, multiplicative and affine ciphers and RSA encryption. For each type of cipher we will first need to know how to encode, then how to decode given key information, and finally, how to crack a cipher given only what type of cipher is used. Cryptography will show us valuable applications of number theory – even number theory that is learned in middle school.

Students are required to complete the Crypto Club Workbook. Much of this work will be done outside of class.

The **Problem Solving** is designed to inform the number theory – often in advance of our study it motivates our conversations as we discover valuable techniques from number theory. Students are required to complete the Problem Solving Project, present at least one problem to the class, and be prepared to solve problems on the midterm and final exams.

**Teaching Applications:** Students will have the opportunity to present middle school mathematics lesson to the class. These lessons will be done by group and require outside of class time to organize.

**Technology:** We will be using TI-84 calculators, EXCEL, and several internet games and activities available on the internet. TI-84 will be available during class but you should consider purchasing your own. A TI-83 will work as well. If you do not have access to a computer on which you can make EXCEL files and experiment with the online games, you may use the computers in room 600 by appointment.

**Grading** Grading is based on the three parts of the course:

- 20% CryptoClub Workbook and CryptoQuizzes
- 20% Problem Portfolio
- 20% Presentation and Teaching application
- 40% Midterm and Final.