Week 1 – Intro to Rigorous Thought

* Introductions. Ask about math backgrounds (10 minutes) Encourage risk-taking.
* Story 1 (Meanie Geanie with 9 stones to measure – 20 minutes).
* Story 2 (Damsel in Distress – 20 ft moat around castle, 19.5 ft boards; 20 minutes)
* 10 minutes break.
* Story 3 (Fountain of Knowledge – 10 oz and 6 oz cups to measure 8 oz drink; 30 minutes)
* Worksheet 1 – get started in class and let finish for homework

Week 2 – Pigeonhole principle and estimation

* Go over #5 (snakes), #6 (spilled beans), #8 handshakes, #1 chip game
* What are examples of things we count? Are there ways to estimate large numbers?
* how many ping-pong balls will fit in this room? how to make a rough estimate
* Work on worksheet 2 together

Week 3 – Fibonacci Numbers

* from last week - % of million digit numbers containing the digit 3
* show pinecones and cauliflowers – spiral counts
* work rabbit problem from worksheet, then #1,2,4
* look at golden rectangle
* proof that
* work on worksheet

Week 4 – Prime Numbers

* #8 – 11 from last week (how to make the lucas sequence converge to phi most rapidly)
* Prime numbers
  + what is means to divide evenly nq=m where n,q,m are natural numbers, then n divides evenly into m
  + The division algorithm: Suppose n and m are natural numbers. Then there exist ! numbers q (for quotient) and r (for remainder) that are either natural numbers or 0, such that m = nq+r and 0 ≤ r ≤ n-1
  + Prime factorization of natural numbers – every natural number is either prime or can be expressed as a product of prime numbers – try it with 1386; Proof. pick a number > 1. If it is not prime, it can be factored into a\*b and either a and b are prime or they can be factored. Keep going. Even though true, may not be practical for really large numbers. This is the foundation for encryption algorithms.
  + There are infinitely many prime numbers – proof: start with finding a prime bigger than 4 by 2x3x4+1; either that is prime or it is the product of primes; if product of primes, then none of those numbers is 2, 3, or 4.
* Modular arithmetic and reading bar codes – start through worksheet 4

Week 5 – Modular arithmetic and reading bar codes

Week 6 – Irrational Numbers