1. (a) Start the Chrome browser.

   (b) Go to `http://cocalc.com`

   (c) Login using **your VCU email address** .

   (d) Click on our class Project.

   (e) Click "New", then "Worksheets", then call it **c29**.

   (f) For each problem number, label it in the Sage cell where the work is. So for Problem 2, the first line of the cell should be `#Problem 2`.

   Problems

2. (**Euclid**) Let $p_1, p_2, \ldots, p_k$ be a list of any k primes. The product p of these primes plus one is
$$p = p_1 \cdot p_2 \cdot \ldots p_k + 1$$
   p is either a prime (different from each of these k primes) or it has a prime factor q also different from each of $p_1, p_2, \ldots, p_k$ (If p is prime then q is just p). This is the main idea in Euclid's proof that there are infinitely many primes. Write a program to find this prime number q given any list, $p_1, p_2, \ldots, p_k$, of primes.

3. The Fibonacci sequence F_n is defined as follows $F_0 = 0$, $F_1 = 1$ and $F_n = F_{n-1} + F_{n-2}$ for $n > 1$. What is the first term in the Fibonacci sequence to contain 1000 digits?

4. $n!$ means $n \times (n-1) \times \ldots \times 3 \times 2 \times 1$. For example, $10! = 10 \times 9 \times \ldots \times 3 \times 2 \times 1 = 3628800$, and the sum of the digits in the number 10! is $3 + 6 + 2 + 8 + 8 + 0 + 0 = 27$. Find the sum of the digits in the number 100! (100-factorial).

5. (**Goldbach**). Goldbach conjectured that ever even number larger than 2 is the sum of two primes. So $= 2 + 2$, $6 = 3 + 3$, $8 = 5 + 3$, etc. Despite much work (with real progress in the last 100 years) the conjecture remains unresolved (open). It is known to be true up to some ginormous n.

   Write a program `goldbach(n)` that takes an even integer greater than 2 as input and returns two primes p_1 and p_2 so that $n = p_1 + p_2$.

   Getting your classwork recorded

   When you are done, before you leave class...

   (a) Click the "Make pdf" (Adobe symbol) icon and make a pdf of this worksheet. (If CoCalc hangs, click the printer icon, then "Open", then print or make a pdf using your browser).

   (b) Send me an email with an informative header like "Math 255 - c29 worksheet attached" (so that it will be properly recorded).

   (c) Remember to attach today's classroom worksheet!