**Last name** _____

**First name** _____

**LARSON—MATH 353–CLASSROOM WORKSHEET 03**
**Getting Started with CoCalc/Sage.**

1. Create a CoCalc account.
   (a) Start the Chrome browser.
   (b) Go to `https://cocalc.com`
   (c) "Create new account" using **your VCU email address** .
   (d) You should see an existing Project for our class. Click on that.
   (e) Make sure you are in your Home directory (if you put files in the Handouts directory they could be overwritten.)
   (f) Click "New", then "Jupyter Notebook", then call it **353-c03**.
   (g) Make sure you have SAGE as the *kernel*.
2. Type in "i" and evaluate.
3. Find $i^3$ by hand, then check it with Sage.

   `plot` is Sage's powerful and flexible command for plotting functions of a single variable.
4. Sketch the graph of $x^3$ on the interval $(-2, 2)$.
5. Sketch the graph of $|x - 1|$ on a "nice" interval.
6. Sketch $\cos x$.
7. Sketch $\cos t$. What happens? What do you think the difference is?

   To sketch multiple plots on the same axis, use the "+" symbol between the `plot` commands.
8. Sketch $x^2$ and $x^3$ on the interval $(-2, 2)$.
9. Use Help on the `plot()` function to learn how to add color to a graph sketch (type and evaluate `help(plot)`).
10. Sketch $x^2$ and $x^3$ on the interval $(-2, 2)$. Make one graph red and the other graph green.

11. Evaluate $f(x) = x^3 - x$. Find$f(1)$, $f(100)$. Try plot(f,-2,2) and plot(f(x),-2,2) and plot(f).

12. Evaluate $c = \frac{27}{14}$. Find f(c).

13. Define a new variable "$y$" by evaluating `var("y")`. Now sketch $g(x) = x^2 + y^2 - 2$ for $-1 \leq x \leq 1$ and $-1 \leq y \leq 1$ by evaluating `plot3d(x**2+y**2-2, (-1,1),(-1,1))`.

14. Solve $x^2 - 1 = 0$ by evaluating `solve(x**2-1,x)`

**Number Theory in Sage**

The following examples are all from our text. We'll just see today that we can compute them in Sage/Cocalc.

15. `prime_range(10,50)`.

16. `[n for n in range(10,30) if not is_prime(n)]`.

17. `gcd(97,100)`.

18. `gcd(97*10^15, 19^20*97^2)`.

19. `factor(1275)`.

20. `factor(2007)`.

21. `factor(31415926535898)`.

22. `len(n.str(10))`.

23. `n.is_prime()` .

24. `p = 2^32582657 - 1`.

25. `p.ndigits()`.

26. Find the first few Euclidean primes. Let $P_1 = 2$. Then at each step find the product of the existing primes plus 1. Add the largest prime factor that is not in your current list of Euclidean primes.

27. (**Density of the Primes**). Find the ratio of the number of primes in the interval $[10^i]$ to $10^i$ for $i = 1 \ldots 9$.

**Getting your classwork recorded**

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

(a) Click the "Print" menu choice (under "File") and make a pdf of this worksheet.

(b) Send me an email (`clarson@vcu.edu`) with an informative header like "Math 353 - c03 worksheet attached" (so that it will be properly recorded).

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