Math 1520 – Quiz 7 – Take Home

This quiz should take you approximately 25 minutes. You may use your book, calculators, software, the internet, and any reference material. In fact, you’ll certainly want some computer assistance to do the integrals on this quiz. Show work, and indicate when you used computer assistance to get an answer.

Do not work together and do not get help (except from Dr. Clair).

(10) 1. The region below is bounded by the \( y \)-axis, the lines \( y = \pm 1 \), and the curve \( y = \log(x) \). Calculate its area.

(10) 2. Find the length of the curve \( y = x^3 - x \) from \((-1, 0)\) to \((1, 0)\).

(You’ll need a calculator or computer to evaluate the integral.)
3. Let \( f(x) = \sqrt{\frac{1}{1+x^2}} \)

Let \( R \) be the infinite region between \( f(x) \) and the \( x \)-axis for \( 0 \leq x < \infty \). Form the solid horn shaped object by rotating \( R \) around the \( x \)-axis. Find its volume (which is finite).

4. Compute the area inside the polar curve \( r = 2 + \cos(3\theta) \), \( 0 \leq \theta \leq 2\pi \).
5. You want to dig a circular mine shaft with a 2 meter radius down to a depth of 1000 meters deep. As you drill, you need to lift the rock debris out of the shaft. How much total work is required? Assume a density of 2600 kg/m$^3$ for the rock, and gravitational constant of 9.8 m/s$^2$. Give your answer in Joules (kg·m$^2$/s$^2$).