November 11th Lab: A bit of long-term review for the final

Exercise 0.0.1. Write the 3rd degree Taylor polynomial for $f(x) = \ln(x)$, centered at $a = 1$.

Exercise 0.0.2. A coin is tossed upward at time $t = 0$ seconds. The velocity of the coin is modeled by the function

$$v(t) = 5 - 9.8t$$

where $v(t)$ is measured in meters per second. What is the displacement (i.e., the net change in position) of the coin between $t = 0$ and $t = 2$?

Exercise 0.0.3. You are designing a shipping container in the shape of a rectangular solid. The container must hold 1000 cubic meters of volume.

The height and width of the container must be equal. Moreover, the front and back faces of the container (whose dimensions are given by height and width) must be made of a material worth 100 dollars per square meter, while all other faces (there are four other faces aside from the front and back faces) must be made of material worth 50 dollars per square meter.

What should the dimensions of this container be to minimize the cost?

(Remember that the volume of a rectangular solid is given by height times width times length.)

Exercise 0.0.4. There is a shape made of those points (x, y) satisfying the equation

$$e^x \sin(y) + \sin(x)e^y = 2.$$

What is the slope of the tangent line to this shape at a point (a, b)?

Exercise 0.0.5. For each value of n below, compute the sum

$$\sum_{i=1}^{n} i.$$

(a) $n = 3$

(b) $n = 5$

(c) $n = 8$

For each n, compare your answers to the expression $n(n+1)/2$.

Exercise 0.0.6. The density of a rod is modeled by the function

$$\rho(x) = x^2 \cos(x^3)$$

where x is some coordinate and $\rho(x)$ is measured in kilograms per centimeter.

How much mass is contained in the portion of the rod between $x = 0$ and $x = 1.5$ meters?