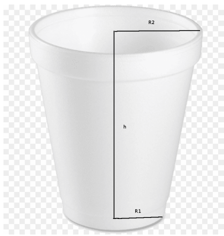
Math 151 Lab 8

Use Python to solve each problem.

1. A styrofoam cup in the shape of the frustrum of a cone has an upper radius twice the lower radius ($R_2 = 2R_1$) and is designed to hold 355 cm^3 (12 ounces).



$$V = \frac{1}{3}\pi h(R_1^2 + R_2^2 + R_1 R_2)$$
$$S = \pi(R_1 + R_2)\sqrt{(R_2 - R_1)^2 + h^2} + \pi R_1^2$$

   (a) Find the dimensions of the cup (R_1, R_2, and h) which minimize the amount of styrofoam used.

   (b) Plot $S(R_1)$ in an appropriate domain to verify that your answer in part (a) is indeed a minimum.

2.

   (a) Find the antiderivative of $f_1(x) = e^{3x}$, $f_2(x) = e^{-6x}$, and $f_3(x) = e^{-\pi x}$.

   (b) Based on your answers to (a), state a general rule for the antiderivative of $f(x) = e^{rx}$.

   (c) Find and simplify the derivative of $g(x) = \frac{1}{-2x}e^{-x^2}$. Does your rule in part (b) extend to other functions in the exponent?

3. Given $f''(x) = 5x^3 + 6x^2 + 2$:

   (a) If $f(0) = 3$, $f'(0) = -2$, find $f'(x)$ and $f(x)$
   (HINT: Python does NOT include the "+C" when you use **integrate**, so you have to put it in yourself, then use the initial conditions to find each C. This type of problem is called an initial value problem)

   (b) If $f(0) = 3$, $f(1) = -2$, find $f(x)$
   (Notice this time you cannot solve for the C values until the end, so give them different names, like $C1$ and $C2$, then solve a system of equations for them. This type of problem is called a boundary value problem)