

MATH 152 – PYTHON LAB 2

Directions: Use Python to solve each problem. ([Template link](#))

1. Consider the equation $x = -y^2 + 5y - 3$.
 - (a) Use **plot_implicit** to graph the equation on $y \in [-2, 5]$.
 - (b) Find the y -intercepts of the graph.
 - (c) Find the volume of the solid by rotating the region bounded by the y -axis and $x = -y^2 + 5y - 3$ about the y -axis using **the disk method**.

2. Let R be the region bounded by $y = \sin(x)$, $y = \cos(x)$, and the y -axis (up to their intersection point).
 - (a) Find the volume of the solid formed by rotating R about the x -axis.
 - (b) Use disks/slicing to find the volume of the solid formed by rotating around the y -axis.
 - (c) After learning the method of cylindrical shells this week in class, use it to find the volume in part (b).

3. A model for the shape of a lemon can be obtained by rotating about the x -axis the region under the graph $f(x) = \frac{12}{(8 + x^4)}$ on the interval $[-3, 3]$, where x is in centimeters.
 - (a) Plot $f(x)$ and $-f(x)$ on the same axes to visualize the lemon. (If you need help creating equal axes, find help [here](#).)
 - (b) Find the surface area of the largest slice of lemon (the area between the $f(x)$ and $-f(x)$ graphs).
 - (c) Find the specific volume of the lemon from part (a).

4. (a) Evaluate the following integrals to show they are all equal.
 - i. $\int_0^1 e^{-\sqrt{x}} dx$
 - ii. $\int_0^{\frac{\pi}{2}} -e^{-\cos(x)} \sin(2x) dx$
 - iii. $\int_0^1 2xe^{-x} dx$
- (b) In a print statement, indicate what substitutions you can make on the first two integrals to obtain the third integral in both cases. (You do not have to compute the integrals using these substitutions, but you should state what u and du would be equal to.)