Due Date

The due date for this lab will be set by your lecturer or recitation instructor. Late submissions will not be accepted.

You are encouraged to discuss this assignment with other students and with the instructors, but the work you hand in should be your own.

Getting Help

For helpful background material, see the web page

https://sites.math.rutgers.edu/courses/251/ComputationalLabs/Computing251.html

This lab will introduce the concept of center of mass and use the computer system to compute the integrals needed for these calculations. This is a topic that can show up in physical problems as an application of multiple integrals.

INSTRUCTIONS

For this assignment, the individualized data from your instructor will consist of a function $\rho(x, y)$, two functions $f(x, y)$ and $\rho(x, y, z)$, and a sphere radius rad.

- **Use Maple, Matlab, or Mathematica to**
  - Compute the center of mass of the square $-1 \le x \le 1$, $-1 \le y \le 1$ with uniform density 1.
  - Compute the center of mass of the square $-1 \le x \le 1$, $-1 \le y \le 1$ with density $\rho(x, y)$.
  - Draw the region between the graphs of $y = L(x)$ and $y = f(x)$ and compute the center of mass of this region if it has density 1.
  - Draw the region between the graph of $z = f(x, y)$ and the sphere of radius rad centered at the origin, and compute the volume and total mass of this region.
- **Your code should consist of the following:**
  - Computation of the center of mass of the square if the density is the constant function 1. **In words**, why does this answer make sense?
  - Computation of the center of mass of the square with density $\rho(x, y)$.
  - Computation of the center of mass of the region between $y = L(x)$ and $y = f(x)$ with constant density 1. To help you with this, the area of this region has been provided with your individualized data. Verify this value to make sure that you are using the correct region.
  - A figure (or two) of the region between $z = f(x, y)$ and the sphere of radius rad centered around the origin.
  - Verification of the volume of this region. It should match the 3D Volume value given in your individualized data.
  - Computation of the total mass of this region if it has density $\rho(x, y, z)$.

- **Hand in a printout of your work. In this printout:**
  - Label all pages with your name and section number. Also, please *staple together* all the pages you hand in.
  - *Clean up your submission by removing the instructions that had errors.*

TIPS

Some of these integrals might be tricky to do on the computer. You may need to first work out by hand what the integral looks like in a different coordinate system and have the computer system carry out that integral. If you do this, you can put a discussion about it in a comment before you do the integral calculation.