PS#16: More fun!!!
Nueva Multivariable Calculus S2022

0. Read Andrew's solution notes to PS#15!

1. **Mister Triple's Magic Box!** Triple Oswald appears, smelling strongly of burnt plywood, with a magic box, three inches high, seven inches long, and four inches deep. He claims that due to an error in the laser cutter, the box is filled with a particular type of evanescent energy. "The robotics kids promised they'd fix the laser cutter, but didn't." When the box is oriented along the axes such that it has one corner at the origin and one corner at $(3, 7, 4)$, the energy at any point in side the box is given by the function:
$$e(x, y, z) = x^2 y + 11z + 13$$
(Like the idea of a laser-cut box holding some sort of magical energy, this is a physically unrealistic function, because it's sometimes negative!) **How much total energy is there in Triple's magic box?** (Calculate it, and explain your thought process, include lots of pictures, et cetera!)

2. Find the volume beneath the surface $z = x^2$ and above the shape formed by the lines $xy = 16$, $y = x$, $y = 0$, and $x = 8$. Find this in *two* different ways—both by making cross-sections parallel to x, and also by making cross-sections parallel to y. Include lots of explanation, pictures, etc.!

3. Find the volume beneath the function $f(x, y) = 7 + x + y$ above a circle/disc of radius five centered at the origin. (Don't look up how to do it—just use your existing knowledge! Try doing it with slices parallel to the axes; if you want, also try it with radial slices. Do you get the same answer?)