0.1. **Jacobians.** Compute the integral of $f(x, y) = xy$ over the following region

(2,4)

(0,2)   (4, 2)

(2,0)
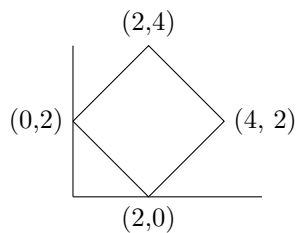
by using the change of coordinates

$$x = u + v \qquad y = u - v$$

0.2. **Setting up triple integrals.** Suppose the density of the following solid is given by $\rho(x, y, z) = x + y$.

z

$(0, 0, 1)$ $(0, 1, 1)$

y

$(0, 1, 0)$

$(1, 0, 0)$

x
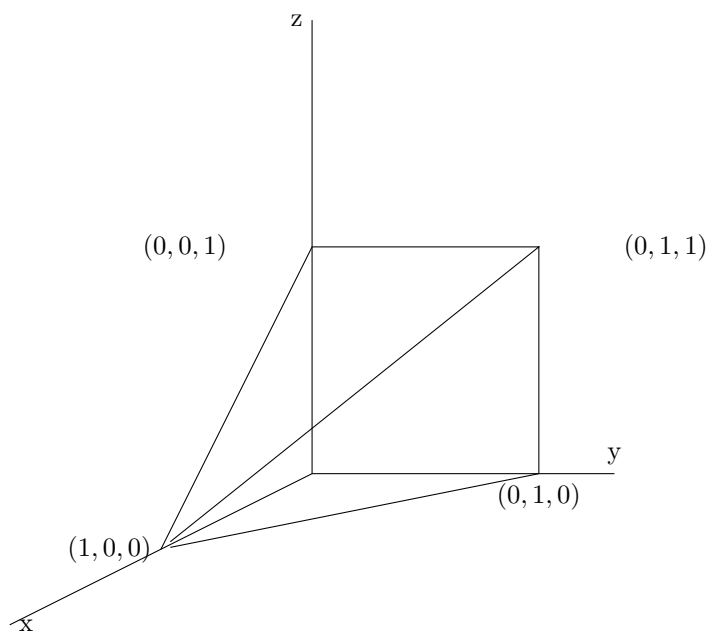
Set up an integral which computes the mass of the object.

0.3. **Cylindrical Coordinates.** Compute the integral of the function $f(x, y, z) = z + x^2 + y^2$ over the region constrained by $0 \leq z \leq 1 - (x^2 + y^2)$. Use cylindrical coordinates.

Bonus Problem. Worth no credit! A *napkin ring* is made from taking a sphere of radius R, and drilling out of it a cylinder with the same axis of radius r. The resulting napkin ring has a height of $h = \sqrt{R^2 - r^2}$. Show that the volume of a napkin ring only depends on h.