Quiz 3

1. Parametrize the following surfaces and set up integrals for their areas.

   - $S$ is the part of $y = 4 - x^2 - z^2$ that is inside $|x| + |z| = 2$.
   - $S$ is the portion of $z = \sqrt{x^2 + y^2}$ that is between $z = 1$ and $z = 3$.

2. Image that we look at the universe in a large length scale (for example, you can image that length 1 means 1000 light years). Then, the stars could be regarded as a continuum distribution of mass, or a cloud of mass in the universe. We now create the coordinate axes and consider the gravitational field generated by the cloud. Suppose the gravitational field is given by

   \[
   \vec{g} = -\left(\frac{x}{(1 + x^2 + y^2 + z^2)^{1/2}}, \frac{y}{(1 + x^2 + y^2 + z^2)^{1/2}}, \frac{z}{(1 + x^2 + y^2 + z^2)^{1/2}}\right).
   \]

   If the density of mass at $(0, 0, 1)$ is $A$ per unit volume, what is then the density of mass at $(0, 1, 0)$?