Worksheet January 27

1. Change $(1, \sqrt{3}, 2\sqrt{3})$ from rectangular to spherical coordinates.

2. Give inequalities in spherical coordinates to describe the solid region inside the sphere $x^2 + y^2 + z^2 = 2$ and outside the double cone $z^2 = x^2 + y^2$.

3. Rewrite
$$\int_0^{2\pi} \int_0^1 \int_{-r}^r zr\, dz\, dr\, d\theta + \int_0^{2\pi} \int_1^{\sqrt{2}} \int_{-\sqrt{2-r^2}}^{\sqrt{2-r^2}} zr\, dz\, dr\, d\theta$$
as a single iterated integral in spherical coordinates.