1 Sphere in Cylindrical Coordinates

Find the surface area of a sphere *using cylindrical coordinates*. Note: The fact that you can describe spheres nicely in cylindrical coordinates underlies the equal area cylindrical map projection that allows you to draw maps of the earth where everything has the correct area, even if the shapes seem distorted. If you want to plot something like population density, you need an area preserving map projection.

2 Total Charge (HW)

For each case below, find the total charge.

(a) A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density

$$\rho(\vec{r}) = 3\alpha\, e^{(kr)^3}$$

(b) A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density

$$\rho(\vec{r}) = \alpha\, \frac{1}{s}\, e^{ks}$$