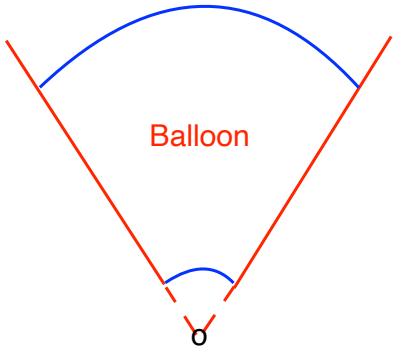
Please note: Setting the integrals properly will be worth no less than 7/10. Further computations are worth no more than 3/10.

1. Set up the triple integral of a function $g(x, y, z)$ over the region R bounded below by the cone $z = (x^2 + y^2)^{1/2}$ and above by the sphere $x^2 + y^2 + z^2 = 4$, in cartesian, cylindrical and spherical coordinates.

2. Using spherical coordinates, compute the mass of the air inside a hot air balloon if the density of the air is $\rho(x, y, z) = 4(1 - z/2)$ and the balloon is bounded by the region between spheres of radii 0.1 and 2 that is within a cone centered on the z-axis of apex angle 90° (angle between two opposite sides of the cone). Note that the center of the spheres and the tip of the cone are all at the origin. Do not evaluate the integral.



3. The density of a spherical ball of radius 3 centered at the origin is given by $g(x, y, z) = 1 + x^2 + y^2$ in kg/m^3. Compute the mass of the portion of the ball where $x \geq 0$, $y \geq 0$, and $z \geq 0$ in

   (a) Cylindrical coordinates (DON'T EVALUATE).

   (b) Spherical coordinates (DON'T EVALUATE).