MA2E01 Tutorial problems #6

(due at the end of your tutorial)

- 1. Use cylindrical coordinates to compute the volume of the solid which is bounded by the paraboloid $z = x^2 + y^2$ from below and by the plane z = 4 from above.
- 2. Use spherical coordinates to compute the volume of the solid which is bounded by the cone $\phi = \pi/3$ from below and by the sphere $\rho = 3$ from above.
- 3. Use cylindrical coordinates to evaluate the integral

$$I = \int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{1-x^2-y^2} x(x^2+y^2) \, dz \, dy \, dx.$$

4. Let R be the region in the xy-plane which is bounded by the lines

$$x + y = 1,$$
 $x + y = 2,$ $y - x = 0,$ $y - x = 2.$

Use an appropriate change of variables to compute the integral $\iint_R (y^2 - x^2) dA$.