1. Compute the following double integral by switching the order of integration
\[ \int_0^1 \int_{x^2}^x \frac{x^3}{\sqrt{x^4+y^2}} \, dy \, dx. \]
(Hint: sketch the domain of integration first.)

2. Compute the integral
\[ \iiint_E x \, dV, \]
where \( E \) is the tetrahedron with vertices \((0,0,0), (2,0,0), (0,1,0), (0,0,1)\).

3. Compute the integral
\[ \int_{-2}^2 \int_0^{\sqrt{4-y^2}} e^{-(x^2+y^2)} \, dx \, dy, \]
by switching to polar coordinates.

4. Evaluate the line integral
\[ \int_C \vec{F} \cdot d\vec{r}, \]
where \( \vec{F}(x, y, z) = \langle y^3, 3xy^2 + e^z, ye^z \rangle \), and the curve \( C \) is parametrized by
\[ \vec{r}(t) = \langle e^t, t^5, \ln(1 + \ln(t^{10} - t^5 + 1)) \rangle, \]
with \( 0 \leq t \leq 1 \). (Hint: there is an easy way and a hard way to do this problem. Don’t do it the hard way!)

5. Calculate the work done by the vector field \( \vec{F}(x, y) = \langle xy, 3y^2 \rangle \) on a particle moving along the path \( \vec{r}(t) = \langle 11t^4, t^3 \rangle \) from \( t = 0 \) to \( t = 1 \).

6. Evaluate
\[ \iiint_E xyz \, dV, \]
where \( E \) is the region in the first octant with \( x^2 + y^2 + z^2 \leq 4 \) (recall that in the first octant we have \( x \geq 0, y \geq 0, z \geq 0 \)).

7. Evaluate
\[ \oint_C y^4 \, dx + 2xy^3 \, dy, \]
where \( C \) is the ellipse \( x^2 + 2y^2 = 2 \). (Hint: use Green’s theorem.)