Closed book, closed notes, scientific calculators only. CELL PHONES OFF. In each problem, show your work.

1. (20 pts.) Calculate the iterated integral

\[ \int_0^1 \int_y^1 y^3 e^{x^2} \, dx \, dy \]

2. (6 + 14 pts.) (a) Calculate \( \iint_{\{x^2+y^2 \leq 4\}} (x^2+y^2)^{3/2} \, dA \)

(b) Let \( T \) be the triangular lamina with vertices \((0,0), (1,0), (0,1)\). If the density of the material is \( k y \) (\( k \) constant), find the \( y \)-coordinate of the center of mass of \( T \).

3. (20 pts.) Let \( R \) be the region above the cone \( z = \sqrt{x^2+y^2} \) but inside the sphere \( x^2+y^2+z^2 = 4 \). Use spherical coordinates to calculate \( \iiint_{R} z^3 \, dV \).

4. (20 pts.) Consider the cylindrical surface \( y^2 + z^2 = 36 \). Take that portion of the surface which lies inside (the pipe) \( x^2 + y^2 = 36 \). What is the surface area of that chunk of the cylinder?

Hint: view things with \( z \)-axis pointing out of the paper.

5. (20 pts.) Let \( R \) be the region above the \( xy \)-plane under the cone \( z = 4 \sqrt{x^2+y^2} \) and inside the cylinder \( x^2+y^2 = 2y \). Calculate \( \iiint_{R} y \, dV \).

Hint: use cylindrical coords.