Problem 1

Integrate $G(x, y, z)$, over the parabolic cylinder $y = x^2$, $0 \leq x \leq 2$, $0 \leq z \leq 3$.

Problem 2

Find the flux of $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$ across the sphere $x^2 + y^2 + z^2 = a^2$ (where $a$ is a constant) in the direction away from the origin.
Problem 3

Find the centroid of the portion of the sphere \( x^2 + y^2 + z^2 = a^2 \) that lies in the first octant \((x, y, z)\) are all positive).

Problem 4

Find the flux of \( \mathbf{F} = -x\mathbf{i} - y\mathbf{j} + z^2\mathbf{k} \) across the portion of the cone \( z = \sqrt{x^2 + y^2} \) that lies between \( z = 1 \) and \( z = 2 \) in the direction away from the \( z \)-axis.