(1) Use the divergence theorem to compute \( \int \int_S \mathbf{F} \cdot \mathbf{n} \, ds \), where \( \mathbf{F} = \langle y, x, z^2 \rangle \) and \( D \) is the region bounded by the paraboloid \( z = x^2 + y^2 \) and the plane \( z = 1 \).

(2) Given a subset \( S \) of \( \mathbb{R}^3 \) defined by
\[
S = \{ u = (u_1, 0, u_3) | u_1 + u_3 \geq 0 \}.
\]
Is \( S \) a subspace? (Why?)

(3) Find the rank of the matrix
\[
A = \begin{pmatrix}
6 & 1 & 3 & 8 \\
4 & 2 & 6 & -1 \\
10 & 3 & 9 & 7 \\
16 & 4 & 12 & 15
\end{pmatrix}
\]