Problems: Flux Through General Surfaces

1. Let \( \mathbf{F} = -yi + xk \) and let \( S \) be the graph of \( z = x^2 + y^2 \) above the unit square in the \( xy \)-plane. Find the upward flux of \( \mathbf{F} \) through \( S \).

2. Let \( \mathbf{F} = -yi + xk \) and let \( S \) be the graph of \( z = x^2 + y \) above the square with vertices at \((0, 0, 0), (2, 0, 0), (2, 2, 0)\) and \((0, 2, 0)\). Find the upward flux of \( \mathbf{F} \) through \( S \).