Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. Evaluate $\int_C \vec{F} \cdot d\vec{r}$ for $\vec{F}(x,y,z) = -2yz\hat{\imath} + y\hat{\jmath} + 3x\hat{k}$ for the boundary of the surface $S: z = 5 - x^2 - y^2, z \ge 1$, oriented upward, using Stokes' Theorem.

2. Evaluate the flux $\iint_S \vec{F} \cdot d\vec{S}$ for $\vec{F}(x,y,z) = x^2\hat{\imath} + xy\hat{\jmath} + z\hat{k}$, where S is the surface of the solid bounded by the paraboloid $z = 4 - x^2 - y^2$ and the xy-plane using the Divergence Theorem.