1. Let $S$ be the portion of the paraboloid $z = x^2 + y^2$ cut out by the planes $z = 1$ and $z = 4$, and suppose $S$ is oriented by a downward-pointing normal vector. Let $\mathbf{F} = (4x, 4y, 2)$.

(a) Find a parametrization of $S$. Indicate the parameter domain and indicate whether your parametrization preserves the orientation of $S$. Explain your answer.

\begin{align*}
\text{parametrization map } G: & \hspace{1cm} \\
\text{parameter domain: } & \hspace{1cm} \\
\text{preserves orientation? } & \hspace{1cm}
\end{align*}

(b) Calculate the flux of $\mathbf{F}$ across the oriented surface $S$.

\text{flux of } \mathbf{F}: \hspace{1cm}