1. (3 points) Compute $\vec{\nabla} f$, where $f(\vec{r}) = \frac{1}{|\hat{z} \times \vec{r}|}$.

2. (a) (1 point) Express $\vec{\nabla} f$ in cylindrical coordinates:

(b) (1 point) Express $\vec{\nabla} \cdot \vec{F}$ in cartesian coordinates:
3. (5 points)

(a) Write $\hat{\rho}$ and $\hat{\phi}$ in hybrid representation.
(Hint: Make a 2D sketch showing the relationship between $\hat{\rho}$, $\hat{\phi}$ and $\hat{x}$, $\hat{y}$.)

(b) Compute $\frac{\partial \hat{\rho}}{\partial \phi}$ and $\frac{\partial \hat{\phi}}{\partial \phi}$ and then express those quantities in cylindrical coordinates.