Problem 1: If $\vec{F}(x,y) = \nabla(x^2+y^4)$, find $\int_C \vec{F}\cdot d\vec{r}$ where C is the quarter of the circle $x^2+y^2=4$ in the first quadrant, oriented counterclockwise.

Problem 2: Compute $\int_C \vec{F}\cdot d\vec{r}$ for each of the following parts.

(a) $\vec{F}(x,y) = \begin{bmatrix} 3x^2 & 4y^3 \end{bmatrix}^T$ and C is the top of the unit circle from $(1,0)$ to $(-1,0)$.

(b) $\vec{F}(x,y) = y\sin(xy)\vec{i} + x\sin(xy)\vec{j}$ and C is the parabola $y = x^2$ from $(1,1)$ to $(2,4)$.

(c) $\vec{F}(x,y,z) = \begin{bmatrix} ye^{xy} & xe^{xy} & \cos(z) \end{bmatrix}^T$ and C consists of the line from $(0,0,\pi)$ to $(1,1,\pi)$ followed by the parabola $z = \pi x^2$ in the plane $y = 1$ to the point $(3,1,9\pi)$.