A. Let $F(x,y) = \langle M(x,y), N(x,y) \rangle = \langle y, -x \rangle$.
Let $\mathcal{C}$ be the unit circle oriented counterclockwise and let R be the region enclosed by $\mathcal{C}$. Calculate the following.

1. $\displaystyle\int_\gamma M\ dx + N\ dy = \int_{\mathcal{C}} F(x,y) \cdot dr$
2. $\displaystyle\iint_R \left(\frac{\partial N}{\partial x} - \frac{\partial M}{\partial y} \right)\ dA$

B. Use Green's Theorem to evaluate $\displaystyle\int_{\mathcal{C}} F(x,y) \cdot dr$ in each case.

1. $F(x,y) = \left\langle y^2 + x^2, x + y \right\rangle$
   $\mathcal{C}$ is the square with vertices $(0,0)$, $(1,0)$, $(1,1)$ and $(0,1)$

2. $F(x,y) = \left\langle y^2 + x, x + y \right\rangle$
   $\mathcal{C}$ is the circle of radius 1 centered at the origin

3. $F(x,y) = \langle x - y, x + y \rangle$
   $\mathcal{C}$ is the circle of radius 3 with center $(1,0)$