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. $\displaystyle\int_{\mathcal{C}} M\ dx + N\ dy = \int_{\mathcal{C}} F(x,y)\cdot dr$
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 $(0,0)$, $(2,0)$, $(2,2)$ and $(0,2)$
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 $(1,0)$