1. Let $C = C_1 + C_2$ where C_1 is the semicircle $x^2 + y^2 = 1$, $y \geq 0$, traced from $(1, 0)$ to $(-1, 0)$, and C_2 is the line segment from $(-1, 0)$ to $(1, 0)$. Compute

$$\int_C y^2 \, dx + x^2 \, dy$$

in two ways: by direct computation and by Green's Theorem.

2. Let $\mathbf{F}(x, y) = \langle e^{x^4} + y, x + y^2 \rangle$.

   (a) Does $\mathbf{F}$ satisfy the condition "$\frac{\partial Q}{\partial x} = \frac{\partial P}{\partial y}$"?

   (b) Do P and Q have continuous first and second order partials? (You don't have to compute them. It should be clear.)

   (c) Is the domain of $\mathbf{F}$ simply-connected?

   (d) Do you have enough information to determine whether $\mathbf{F}$ is conservative without actually trying to find a function f such that $\mathbf{F} = \nabla f$?