Name:

1. The following vector field is conservative:

$$\mathbf{F} = \left\langle y\cos(xy), x\cos(xy) + 3y^2 \right\rangle$$

a) Find **all** potential functions for $\mathbf{F}$.

b) Doing very little work, compute $\int_C \mathbf{F} \cdot d\mathbf{R}$ where C is the straight line from the origin to the point $(1, \pi)$.

2. Recall that Green's Theorem states that for any curve C traversing the boundary (counterclockwise) of a simply connected region $\mathcal{D}$

$$\int_C P\,dx + Q\,dy = \iint_{\mathcal{D}} \left(-\frac{\partial P}{\partial y} + \frac{\partial Q}{\partial x}\right) dA.$$

Use Green's theorem to compute the line integral $\int_C y^3\,dx - x^3\,dy$ where C is the circle $x^2 + y^2 = 9$ given the counter clockwise orientation. For full credit, your solution must employ Green's Theorem.