Name:

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

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

Alternatively if $\mathbf{F} = \langle P, Q \rangle$ this can be expressed

$$\int_C \mathbf{F} \cdot d\mathbf{r} = \iint_{\mathcal{R}} \operatorname{curl} \mathbf{F}\; dA.$$

Use Green's theorem to compute the line integral $\int_C xy\;\, dx + (x - y)\;\, dy$ where C is the boundary of the triangle with vertices $(0, 0)$, $(2, 0)$ and $(0, 2)$. For full credit, your solution must employ Green's Theorem.

2. Consider the region $\mathcal{S}$ of points (x, y, z) given by $y = 2 - x^2$ and with $0 \leq z \leq y$.

a) Find a parameterization of the region $\mathbf{r}(u, v)$. You may find it useful to let u parameterize the x coordinate (in which case the y coordinate is also determined by u).

b) [Extra Credit] Write down a double integral that can be used to compute the surface area of this region. DO NOT actually compute the surface area.