

Name: \_\_\_\_\_

**Instructions:** Answer all questions. Calculators are forbidden. Show work to earn partial credit.

**Problems:**

1. Find a normal vector to the surface  $\Phi(u, v) = \langle u^2, v - u, v^4 \rangle$  at the point  $(u, v) = (2, 1)$ .
2. Write the integral which gives the surface area of the surface from problem 1, for  $0 \leq u \leq 1$ , and  $2 \leq v \leq 3$ . (Find the bounds and the integrand, but do not evaluate).
3. Write Green's Theorem.
4. Calculate  $\oint_C ydx - xdy$  for C the unit circle parameterized counterclockwise.

**Solutions:**