First Name: _____   ID#_____

Last Name: _____

Section: _____ $= \begin{cases} 3a & \text{Tuesday with Allen Boozer} \\ 3b & \text{Thursday with Allen Boozer} \\ 3c & \text{Tuesday with Steven Gagniere} \\ 3d & \text{Thursday with Steven Gagniere} \\ 3e & \text{Tuesday with Francis White} \\ 3f & \text{Thursday with Francis White} \end{cases}$

Rules.

- There are **FOUR** problems; ten points per problem.

- There are two extra pages at the end. You may also use the backs of pages.

- No calculators, computers, notes, books, crib-sheets,...

- Out of consideration for your class-mates, no chewing, humming, pen-twirling, snoring,... Try to sit still.

- Turn off your cell-phone.

1	2	3	4	$\sum$

(1) Evaluate
$$\int_0^1 \int_0^{\sqrt{1-x^2}} xy^3 \, dy \, dx$$
by changing variables via $x = uv$ and $y = u\sqrt{1-v^2}$.

(2) Compute
$$\int_\gamma \sqrt{x^2 + 9y^2} \, ds$$
where γ passes from $(0,0)$ to $(1,1)$ along the curve $y = x^3$.

(3) (a) For what value of λ is the vector field

$$\vec{F}(x,y) = \begin{bmatrix} \dfrac{-y^2}{(x+1)^2} \\ \dfrac{\lambda y}{x+1} \end{bmatrix}$$

conservative in the region where $x > -1$?

(b) Find a potential with this value of λ.

(4) Let $\mathcal{H}$ denote the surface where $z^2 = 1 + x^2 + y^2$ and $0 \le z \le 2$. Compute

$$\int_{\mathcal{H}} z \, dS$$

extra paper

extra paper