PRACTICE FINAL (No calculators, etc.)

I. Give the formula for acceleration in terms of its two components. Explain what these two are with relation to Newton's law of inertia. What does the formula tell us about the two kinds of acceleration?

II. Explain how to calculate flux from a region in a vector field (loss of fluid, where the vector field is flow). Why is this the right calculation? Calculate the flux of the vector field $\vec{F}(x,y)=(x,xy)$ out of the square with vertices $(0,0),(1,0),(0,1)$ and $(1,1)$.

III. a) Define simple closed curve.

b) Draw one, Draw a curve which isn't simple, Draw one which isn't closed. Label them.

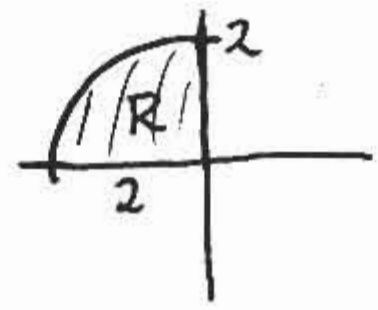
c) Prove if $\mathcal{C}$ is a simple closed curve and A is the area it encloses, then $\oint y\,dx = -A$. (if $\mathcal{C}$ is parametrized counterclockwise)

IV. Prove that if $F(t)$ parametrizes $\mathcal{C}$, a curve, by arclength, then $F'(t) \perp F''(t)$ for all t.

V. a) Define tangent plane to a surface, S, at a point, P.

b) If S is the surface given by $2xy - x^2 + \frac{y^2}{2} = 3$, Find the tangent plane to S at $(1,2,1)$.

VI. Calculate $\iint_R \sqrt{x^2+y^2}\, dA$ where R is the quarter circle



(Hint: use polar coordinates)

VII. Find the point on the plane $x+y-z=1$ closest to the origin. (Hint: minimize (distance)^2 and use lagrange)

VIII. a) Define the three kinds of line integrals

b) Calculate $\int_C 2xy^2\, ds$ where C is the line from (0,0) to (2,1).