Ma224011: Take Home Part of Final Examination :

Instructions: This must be completed by May 8th. I will need a hardcopy by the end of the final exam period just to be explicit I mean 4pm on May 8th. You are free to work with others but you must provide a solution in your own words in the end. Because this is a take home exam I expect you to explain any nontrivial steps. If you use a theorem then you should say which one you used, how **you** used it and why you could use it.

TAKEHOME PROBLEM ONE: (10pts) Suppose that $F =< \sin(y), x\cos(y), -\sin(z) >$. Show that F is a conservative vector field by an argument involving $\nabla \times F$. Then give a second proof by actually deriving the potential function f such that $F = \nabla f$.

TAKEHOME PROBLEM TWO: (10pts) Suppose that $F =< x, y, z >$. Calculate the flux of F through the outwardly oriented ellipsoid E given below, (a, b, c are positive constants),

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$$

TAKEHOME PROBLEM THREE: (10pts) Suppose that $F =< xe^y z, y^2 e^x yz, x^2 + \sin(xy + z^2) + 42 >$. Let us again consider the ellipsoid given in problem two. This time calculate

$$\iint_E (\nabla \times F) \cdot dS$$

"... Yeah, I was out of touch
  But it wasn't because I didn't know enough
  I just knew too much
  Does that make me crazy ?..." **Hint: use the Theorems.**