5. (15) (**Show all work**). Consider the vector field $\mathbf{F}(x, y, z) = (2x, 3y^2z, y^3 + \sin z)$.

(a) Show that the vector field $\mathbf{F}$ is a gradient field by finding a function f with $\mathbf{F} = \nabla f$ and $f(0, 0, 0) = 4$. Show a general method for finding f. Guessing gets you little credit.

(b) Compute the curl, $\nabla \times \mathbf{F}$.

(c) Compute the divergence, $\nabla \bullet \mathbf{F}$.

6. (15) (**Show all work**). Show that the path $\mathbf{c}(t) = (3e^t - 3, \sin t + 3, t^4/4 + t - 2)$ is tangent to the surface $F(x, y, z) = x^5 + y^2 - 3z^2 + xyz = -3$ at the point corresponding to $t = 0$. (In particular, this means that the tangent line to the curve would have to lie in the tangent plane to the surface).

7. (15) Parametrize the curve which is the intersection of the level surface $-17x^2 + 9y^2 + 2z^2 + 25 = 0$ and the plane $3x + z = 1$. *Hint:* the curve is an ellipse.

NAME (Print!): ____________________

Math 13

21 October 2003
First Hour Exam

This is the take-home part of your first exam. You may feel free to consult your textbook or your notes, **but you may not consult any other source, animate or inanimate**. Make your solutions complete, accurate and easy to read.

Problem	Points	Score
5 (Take home)	15	
6 (Take home)	15	
7 (Take home)	15	
Total	45	