Math 241 Project 3 **Due in Discussion on Tuesday 5/1/2012**

What to Submit:

For this project you will need to turn in a printout of your published m-file. Some requirements and comments:

- Put the command lines for each question in the m-file separated by a blank line then a `%%` line and then another blank line.
- Each question should start with a `clear all` line followed by the declaration of any symbolic variables necessary for that problem. In other words each question should be completely self-contained.
- All 3D graphs should have `view([10 10 10])` set.
- I've made some notes for those who are interested (NFI) but they're not relevant to getting the project done.

The questions are:

1. Plot the portion of $x^2 + z^2 = 9$ above the xy-plane and between $y = -1$ and $y = 2$.
2. Plot the portion of the cone $z = 9 - \sqrt{x^2 + y^2}$ inside the cylinder $r = 2$.
3. Plot the vector field $\bar{F}(x, y) = 0.2(x + y)\,\hat{\imath} + 0.2(x - y)\,\hat{\jmath}$ using `meshgrid(-5:1:5,-5:1:5)`.
4. A piece of wire is in the shape of the circle $x^2 + y^2 = 1$. The density at any point is given by $\delta(x, y) = x^2 + y^4$. Find the mass of the wire.
   NFI: $\delta(x, y)$ could be in grams per cm in which case the mass would be grams.
5. Evaluate the line integral $\int_C (x + y)\ ds$ where C is the straight line segment from $(0, 1, 1)$ to $(3, 2, 2)$.
6. Evaluate the line integral $\int_C yz\ dx + yz\ dy + y\ dz$ where C is the top half of $y^2 + z^2 = 4$ in the yz-plane traveling from left to right.
7. Suppose Σ is the portion of the plane $z = 10 - x - y$ inside the cylinder $x^2 + y^2 = 1$. The surface Σ is submerged in an electric field such that at any point the electric charge density is $\delta(x, y, z) = x^2 + y^2$. Find the total amount of electric charge on the surface.
   NFI: $\delta(x, y, z)$ could be in coulombs per cubic centimeter in which case the total charge would be in coulombs.
8. A fluid is flowing through space following the vector field $\bar{F}(x, y, z) = y\,\hat{\imath} - x\,\hat{\jmath} + z\,\hat{k}$. A filter is in the shape of the portion of the paraboloid $z = x^2 + y^2$ having $0 \le x \le 3$ and $0 \le y \le 3$, oriented inwards (and upwards). Find the rate at which the fluid is moving through the filter.
   NFI: The fluid flow F could have units $g/(cm^2 s)$ (really $\bar{F}$ is $\delta\bar{F}$ where δ has units g/cm^3 and $\bar{F}$ has units cm/s) in which case the total flow would be in grams per second.