Math 21C **Homework #8** **due 7/21/08**

1. Zaphod Beeblebrox's homeworld experiences a time-dependent downward gravitational acceleration of $\frac{1-t}{1+t^2}\frac{m}{s^2}$. Calculate the range of an arrow fired with initial velocity $\mathbf{v}$ at time $t = 0$ over level ground.

2. Calculate the length of one cycle of the "tennis ball curve",
$\mathbf{p}(t) = \begin{pmatrix} \cos t \\ \sin t \\ \sin 2t \end{pmatrix}$

3. Prove properties 2, 5, 6, and 7 from page 896 of the text.

4. Explain in words what the cross product means geometrically.

5. A mosquito travels in a circle around a hiker's head. Assuming the hiker is moving horizontally in a straight line, write a parameterization for the mosquito's path as a function of time. Be sure to specify radius of the circle and height of the hiker as variables.

6. Graph the surface defined by the equation $x^2 + y = 3 - z^2$.

7. A hummingbird's trajectory is given by the helix $\mathbf{p}(t) = \begin{pmatrix} \cos t \\ \sin t \\ t \end{pmatrix}$. Let $\mathbf{v}$(t) denote the bird's velocity as a function of time. Let $\theta(t)$ denote the angle between $\mathbf{v}$(t) and $\begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$. Compute $\lim_{t\to\infty} \theta(t)$.