Friday November 23, 2001

1. (20%) Sketch the surfaces in *xyz*-space:

   a) $z = \sqrt{x^2 + y^2}$

   b) $\rho = \sqrt{2}\ \sec\ \phi$

2. (30%) Consider the curve $(\gamma): \mathbf{r}(t) = (\sin t)\mathbf{i} + (\sqrt{2}\cos t)\mathbf{j} + (\sin t)\mathbf{k}$.

   a) (20%) Find $\mathbf{T}, \mathbf{N}, \mathbf{B}, \kappa,$ and τ.

   b) (5%) Write the acceleration $\mathbf{a}$ in the form $\mathbf{a} = a_T\mathbf{T} + a_N\mathbf{N}$.

   c) (5%) Find the length of the portion of (γ) from $t = 0$ to $t = 1$.

3. (15%) Find (if any) $\lim_{(x,y)\to(0,0)} \dfrac{2x}{x^2 + x + y^2}$

4. (20%) (a) Find the function's domain, (b) find the function's range, (c) describe the function's level curves, (d) find the boundary of the function's domain, (e) determine if the domain is an open region, a closed region, or neither, and (f) decide if the domain is bounded or unbounded of $g(x,z) = \sqrt{x^2 - z}$

5. (15%) Let $f(x,y) = \begin{cases} \dfrac{\sin(x-y)}{|x|+|y|} & ,|x|+|y| \neq 0 \\ 0 & ,(x,y) = (0,0) \end{cases}$

   Is f continuous at the origin? Why?