Quiz 10 Name: Solutions
Math 202 F01 4/27/05

1. A parameterized surface S is given by $\Phi(u,v) = (u\cos(v), u\sin(v), u)$, where $0 \le u \le 2$ and $0 \le v \le 2\pi$. Begin computing the flux of the vector field $F(x,y,z) = (y, -z, 0)$ across S. (You may use either orientation of S for this.) Leave your answer in the form of an iterated integral — do not evaluate it completely.

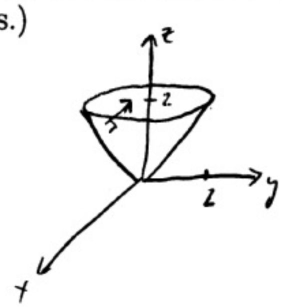
$T_u = (\cos v, \sin v, 1)$

$T_v = (-u\sin v, u\cos v, 0)$

$T_u \times T_v = (-u\cos v, -u\sin v, u\cos^2 v + u\sin^2 v) = (-u\cos v, -u\sin v, u)$

So
$$\iint_S F \cdot d\vec{S} = \int_0^{2\pi}\int_0^2 (u\sin v, -u, 0)\cdot(-u\cos v, -u\sin v, u)\, du\, dv$$
$$= \int_0^{2\pi}\int_0^2 -u^2\sin v\cos v + u^2\sin v \; du\, dv$$

2. Sketch the surface S of problem 1. (Be sure you label the x, y, and z axes.)



Note u, v are playing the role of r, θ of polar coordinates in the formulas for x, y

So $z = u$ means $z = r$ in cylindrical coordinates

3. Add a normal vector to the sketch of S to show which orientation you used for your calculation in problem 1, and *briefly explain* how you know you used that orientation. (No credit will be given for a drawing without an explanation.)

$\vec{n} = T_u \times T_v = (-u\cos v, -u\sin v, u)$ has z-component $u > 0$, so it points "upwards" and hence "inwards".