# Annie's Survival Kit 7 - Math 324

1. (10 points)  (a) (4 points) Let $\mathbf{F} = \langle x, y, z \rangle$ and let $S$ be the part of the surface $z = \sqrt{x^2 + y^2}$ lying underneath the plane $z = 1$, where $\hat{\mathbf{n}}$ is pointing generally upwards/inwards. Draw $S$ and a few vectors for $\hat{\mathbf{n}}$ and $\mathbf{F}$.

   (b) (6 points) Find $\int\int_S \mathbf{F} \cdot \hat{\mathbf{n}}\, dS$ either by parametrizing $S$ or in any other way. Make sure every part of your answer is clear.

2. (10 points)  (a) (8 points) Find the moment of inertia around the $z$-axis for the surface $x^2 + y^2 = 4$ with $0 \le z \le 1$ and with density equal to the square of the distance to the $z$-axis.

   (b) (2 points) Without doing further calculations, determine whether or not the moment of inertia around the $z$-axis for the surface $x^2 + y^2 = 4$ with $1 \le z \le 2$ is the same as in part (a). Explain your answer.

3. (10 points) Find the flux through the surface $x^2 + y^2 + (z - 1)^2 = 1$ oriented outwards/upwards for $\mathbf{F} = \langle -x, -y, -z \rangle$.