

Math 210 (Lesieutre)
14.6: Surface integrals
April 17, 2017

Problem 1. Evaluate the indicated flux integrals $\iint_S \mathbf{F} \cdot \mathbf{n} \, dS$ without making any computations.

a) S is the unit sphere, $\mathbf{F} = \mathbf{k}$ is a constant upward field.

b) S is the unit sphere, $\mathbf{F} = \langle x, y, z \rangle$.

Problem 2. Compute the flux of the field $\langle 2z, 3, 2x \rangle$ across the top face of a tetrahedron with vertices at $(1, 0, 0)$, $(0, 1, 0)$, and $(0, 0, 1)$. (Hint: the equation for the top is $z = 1 - x - y$.)

Problem 3. Let V be a cylinder with base at the origin, radius 3, and height 4, and consider the vector field $\mathbf{F} = \langle z^2, 3y, 1 \rangle$.

a) Compute the flux of \mathbf{F} across S_1 , the outer wall of the cylinder.

b) Compute the flux of \mathbf{F} across S_2 , the top of the cylinder. (Use an upward-pointing normal vector.)

c) Compute the flux of \mathbf{F} across S_3 , the bottom of the cylinder. (Use a downward-pointing normal vector.)

d) What is the total outward flux across the cylinder?