

MONDAY 8TH DECEMBER : SURFACE INTEGRALS

Reading: sections 13.6

Homework: see www.courses.fas.harvard.edu/~math21a/

1. SURFACE INTEGRALS OF FUNCTIONS

(1) Compute

$$\iint_S yz \, dS$$

where S is the part of the plane $z = y + 3$ which lies inside the cylinder $x^2 + y^2 = 1$.

(2) Find the mass of the part of the cone $z = \sqrt{x^2 + y^2}$ with $1 \leq z \leq 4$ if the density at the point (x, y, z) is

$$f(x, y, z) = 10 - z$$

2. FLUX INTEGRALS

(1) Find the flux of the vector field

$$\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z^4\mathbf{k}$$

through the part of the cone $z = \sqrt{x^2 + y^2}$ beneath the plane $z = 1$, oriented downward.

(2) Compute the flux of the vector field

$$\mathbf{F}(x, y, z) = \langle x, y, z \rangle$$

through the sphere of radius 2 about the origin.

3. A HARDER PROBLEM

Show that simply-connected surfaces are orientable. Give an example of a non-simply-connected orientable surface.