

Math 210 (Lesieutre)  
14.7: Stokes' theorem, 1  
April 20, 2017

**Problem 1.** Let  $S$  be the portion of the paraboloid  $z = 1 - x^2 - y^2$  lying above the plane  $z = 0$ . Check Stokes' theorem for the field  $\mathbf{F} = \langle x, y, z \rangle$ .

**Problem 2.** Let  $S$  be the top half of a sphere of radius 2. Compute  $\iint_S \mathbf{k} \cdot \mathbf{n} \, dS$ .  
(Hint: for the field  $\mathbf{F} = \langle 0, x, 0 \rangle$ , we get  $\nabla \times \mathbf{F} = \langle 0, 0, 1 \rangle$ .)

**Problem 3.** What does Stokes' theorem tell us in the case that  $\nabla \times \mathbf{F} = 0$ ? Does this seem plausible?

**Problem 4.** Let  $S$  be a cylinder of height 2 and radius 1 centered at the origin, not including either of the ends. This region has two boundary components. Find an orientation for each, and verify Stokes' theorem for the field  $\mathbf{F} = \langle yz, -xz, 0 \rangle$ .