

Math 210 (Lesieutre)

14.6/7: Stokes' and divergence theorems

April 21, 2017

Problem 1. 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 $\mathbf{F} = \langle yz, -xz, 0 \rangle$.

Problem 2. Find the flux of the field $\mathbf{F} = \langle x + y \sin z, xz, 4z \rangle$ across a sphere of radius 2 centered at the origin.

Problem 3. Let S be portion of the paraboloid $z = 1 - x^2 - y^2$ lying above the xy -plane. Compute the flux of the vector field from Problem 2 across S . (Hint: the divergence theorem will make your life easier.)

Problem 4. Check that the divergence theorem is true by computing both sides for the field $\mathbf{F} = \langle x, 2y, 3z \rangle$ and the region $D = \{(x, y, z) : x^2 + y^2 + z^2 \leq 9\}$.