

18.02 Recitation
Problems
23 November 2011

1. Let \vec{F} be the field $\vec{F}(x, y, z) = \langle x, y, z \rangle$. What is the flux of \vec{F} across the unit sphere? Across a sphere of radius a ? Try to find these without doing any computation.
2. What are some vector fields that have flux 0 across the unit sphere? What are some that are tangent to the unit sphere at every point?
3. Consider the field \vec{F} from the first problem. Compute the flux across a square in space with vertices at $(\pm 1, \pm 1, 1)$ by integrating directly.
4. Find the flux of \vec{F} across a cylinder whose base is a circle in the xy -plane of radius 2 and whose height is 3.
5. Find the flux of \vec{F} across the unit sphere. This time do it by computing directly.
6. Find the flux of \vec{F} across the paraboloid $z = x^2 + y^2$ in the region over the square with vertices $(\pm 1, \pm 1)$. Interpret the sign of your answer.
7. Redo the computation for the cylinder above using the divergence theorem.