

Math 53 - Multivariable Calculus

Quiz # 10

April 20th, 2012

Exercise 1. Suppose there is an elementary particle, of charge g , located at the origin that generates a force field given by $\vec{A}(\vec{r}) = g\frac{\vec{r}}{r^3}$, where r denotes the magnitude of \vec{r} . Use a surface integral to compute the flux of this force through a sphere of radius $r > 0$ centered at the origin (i.e., DON'T use the divergence theorem, explicitly compute the surface integral).

Exercise 2. Let S_1^2 denote the unit sphere, $S_1^2 = \{(x, y, z) \in \mathbb{R}^3 \mid x^2 + y^2 + z^2 = 1\}$. Use the divergence theorem to compute the surface integral $\iint_{S_1^2} (x^2 + y + z) dS$.

Exercise 3. Compute the flux of $\vec{F}(x, y, z) = \langle xy \sin(z), \cos(xz), y \cos(z) \rangle$ through any positively oriented closed surface S that contains the origin.