Math 13: Written Homework #5.
Due Monday, February 11, 2013.

1. (§16.2, #16) Evaluate the line integral

$$\int_C (y + z)\, dx + (x + z)\, dy + (x + y)\, dz,$$

where C is the concatenation of the line segment from $(0, 0, 0)$ to $(1, 0, 1)$ with the line segment from $(1, 0, 1)$ to $(0, 1, 2)$.

2. (§16.2, #34) A thin wire has the shape of the portion of the circle of radius a centered at the origin which lies in the first quadrant. If the density function is $\rho(x, y) = kxy$, then mass and center of mass of the wire.

3. (§16.1, #26) Find the gradient vector field ∇f of $f(x, y) = \sqrt{x^2 + y^2}$ and sketch it.

4. (§16.2, #32(a)) Find the work done by the force field $\mathbf{F}(x, y) = \langle x^2, xy \rangle$ on a particle that moves once around the circle $x^2 + y^2 = 4$ oriented in the counterclockwise direction.

5. (§16.2, #42) The force exerted by a unit electric charge at the origin on a charged particle at the point (x, y, z) is $\mathbf{F}(\mathbf{r}) = \mathbf{r}/|\mathbf{r}|^3$, where $\mathbf{r} = \langle x, y, z \rangle$. Find the work done as the particle moves along a straight line from $(2, 0, 0)$ to $(2, 1, 5)$.