Math 13 - Winter 2014
Homework 5
Due Wednesday, 12 Feb. 2014.

- Except for problems that are stated explicitly, all problems are from Stewart Multivariable Calculus, 7th Edition.
- Please show all of your work (writing a list of answers is not sufficient).
- Please indicate the people you worked with.
- Please staple your pages together.

1. Evaluate the double integral $\iint_R (x^2 - xy + y^2)\mathrm{d}A$, where R is the plane region bounded by the ellipse $x^2 - xy + y^2 = 2$, using the transformation $T(u, v) = \begin{bmatrix} \sqrt{2}u - \sqrt{2/3}v \\ \sqrt{2}u + \sqrt{2/3}v \end{bmatrix}$.

2. Find the gradient vector field ∇f of f and sketch it if
   (a) $f(x, y) = x^2 - y$
   (b) $f(x, y) = \sqrt{x^2 + y^2}$

3. (a) Sketch the vector field $\mathbf{F}(x, y) = \langle y, 1\rangle$.
   (b) Read problem #35 on page 1086 of your text (Section 16.1) for the definition of a **flow line**. With the help of your sketch in part (a), determine an equation for the **flow line** of the vector field $\mathbf{F}$ through the point $(1, -1)$.

4. Section 16.2 # 8.

5. Evaluate the line integral $\int_C (xy+z)\mathrm{d}s$ over the helix parameterized by $\mathbf{r}(t) = \langle \cos(3t), \sin(3t), 4t\rangle$, $0 \le t \le \pi$.

6. (a) Find the mass of a wire in the shape of a circle with radius 3 and center $(0, 3)$ if its linear mass density at any point (x, y) on the wire is equal to its squared distance from the y-axis.
   (b) For the same wire as in part (a), determine the wire's moment of inertia about the y-axis.