1. **(6 points)** Evaluate the line integral $\int_C \mathbf{F} \cdot d\mathbf{r}$ where $\mathbf{F}(x, y) = e^x\mathbf{i} - 2xy\mathbf{j}$, and C is given by the path $\mathbf{r}(t) = \langle t, t^2$ from $(0, 0)$ to $(2, 4)$.

2. **(3 points)** Identify the vector field $\mathbf{F}(x, y) = (1 + 2xy + \sin x)\mathbf{i} + (x^2 - 3)\mathbf{j}$ as conservative or nonconservative; if conservative, find its potential function.

3. **(7 points)** Use Green's Theorem to evaluate $\int_C x^2y^2dx + 8xy^3dy$, where C is the triangular path consisting of linear subpaths from $(0, 0)$ to $(1, 3)$ to $(0, 3)$ and back to $(0, 0)$.

4. **(4 points)** Find the divergence and curl of the vector field $\mathbf{F}(x, y, z) = 0i + ye^x\mathbf{j} + ye^z\mathbf{k}$

5. **(2 point bonus)** Let $f(x, y, z)$ and $g(x, y, z)$ be scalar-valued functions. Show that the vector field given by the cross product of their gradients $(\nabla f \times \nabla g)$ has zero divergence.

Friday, December 3, 2010