Math 175 - Exam 3, December 2, 2009 Name:____

Problem 1 (20 points). Evaluate the integral $\int_C xe^y\, ds$ where C is portion of the circle $x^2 + y^2 = 4$ going counterclockwise from $(2, 0)$ to $(\sqrt{2}, \sqrt{2})$.

Problem 2 (20 points). Evaluate $\iiint_E (x^2+y^2+z^2)^2 \, dV$ where E is the region above the xy-plane and in between the spheres $x^2+y^2+z^2=1$ and $x^2+y^2+z^2=4$.

Problem 3 (20 points). Evaluate $\int_C F\cdot\, d\mathbf{r}$, where $F(x,y,z) = yz\mathbf{i} + (x+1)z\mathbf{j} + ((x+1)y+1)\mathbf{k}$ and C is the curve given by $r(t) = (\cos t, \sin t, t)$, for $0 \le t \le 2\pi$.

Problem 4 (20 points). Evaluate the integral $\int_C -y^3\ dx + x^3\ dy$ where C is the curve orineted positively which is made of the line segment from $(0,0)$ to $(\sqrt{2},0)$, the counterclockwise arc on $x^2+y^2=2$ from $(\sqrt{2},0)$ to $(1,1)$, and also the line segment from $(1,1)$ to $(0,0)$.

Problem 5 (20 points). Find the curl and divergence of the vector field $F(x, y, z) = e^x\mathbf{i}+e^{xy}\mathbf{j}+e^{xyz}\mathbf{k}$.

Problem 6 (Extra Credit - 10 points, no partial credit). Let $f : \mathbb{R}^3 \to \mathbb{R}$ be the function $f(x, y, z) = ze^{x^2+y^2+z^2}$. Find a vector field G such that div $G = f$ and $G(0, 0, 0) = \mathbf{i} + \mathbf{j}$.