Math 264: Advanced Calculus **Winter 2008**

Assignment 3 **due Thursday, March 6**

Every problem is worth 5 points. Due to time constraints, some problems may not be marked.

Problem 1 (Adams, §16.2 # 14). Verify the identity

$$\nabla \bullet (f(\nabla g \times \nabla h)) = \nabla f \bullet (\nabla g \times \nabla h)$$

for smooth functions f, g and h.

Problem 2 (Adams, §16.3 # 4). Evaluate

$$\int_C x^2 y \, dx - xy^2 \, dy,$$

where C is the clockwise boundary of the region $0 \leq y \leq \sqrt{9 - x^2}$.

Problem 3 (Adams, §16.3 # 7). Sketch the plane curve $C : \mathbf{r}(\mathbf{t}) = (\sin t, \sin(2t)), 0 \leq t \leq 2\pi$. Evaluate $\int_C \mathbf{F} \bullet d\mathbf{r}$, where $\mathbf{F} = (ye^{x^2}, x^3 e^y)$.

Problem 4 (Adams, §16.4 # 12). Find the flux of $\mathbf{F} = (y + xz, y + yz, -2x - z^2)$ upward through the first octant of the sphere $x^2 + y^2 + z^2 = a^2$.

Problem 5 (Adams, §16.4 # 14). Evaluate

$$\int \int_S \mathbf{F} \bullet \mathbf{N} dS,$$

where $\mathbf{F} = (3xz^2, -x, -y)$ and S is that part of the cylinder $y^2 + z^2 = 1$ that lies in the first octant and between the planes $x = 0$ and $x = 1$.