Short Exam 2 Name:_____

Physics 403: Mathematical Methods February 15, 2008

Complete this quiz showing all work.

1. What is the unit vector perpendicular to the plane defined by

$$3x + 6y - z = 4\,?$$

2. Find the Taylor series expansion of the function $f(x)$ about the point $x = 3$ for

$$f(x) = \sqrt{1 + x}.$$

Write this as $f(x) = (3 + \delta)$ and show the Taylor series up to terms δ^3.

3. Consider the vector field $\vec{A} = 2x\hat{z}$ and a cube whose sides have unit length. Let the cube sit so that

$$0 \leq x \leq 1 \qquad 0 \leq y \leq 1 \qquad 0 \leq z \leq 1$$

i.e. the bottom of the cube is in the (x-y) plane, the left hand side is in the (x-z) plane, and the back of the cube is in the (y-z) plane.

   (a) Call the 6 sides of the cube the front, back, RHS, LHS, top and bottom. What are the area elements $d\vec{a}$ for each of the six sides of the cube?

   (b) For each side of the cube, explain whether there is any flux of $\vec{A}$ through the face explicitly using $\vec{A} \cdot d\vec{a}$.