North Carolina State University
PY785 Quiz
Due: Friday, 28 October 2011
Instructor: T. Schaefer

Name:

1	_____
2	_____
Total	_____

Instructions

1. This quiz will be graded, but the grade will not be recorded.
2. There are two problems. Each problem is worth 15 points.
3. Write your answers in the spaces provided for each problem. Show calculations there or on the facing page.

1. The (cartesian) quadrupole moment tensor of a charge distribution $\rho(\vec{x})$ is given by $Q_{ij} = \int d^3x(3x_i x_j - \vec{x}^2\delta_{ij})\rho(\vec{x})$.

   (a) Show: If the total charge and the electric dipole moment vanish then the quadrupole tensor is independent of the origin of the coordinate system (5 points).

(b) The four corners of a square in the xy-plane with sides of length a (parallel to the x, y axis) are occupied by charges $\pm Q$ in an alternating pattern. Determine the quadrupole moment tensor (10 points).

2. A perfectly conducting sphere is placed in a uniform electric field pointing in the z-direction. Compute the electrostatic potential everywhere, and the surface charge density on the sphere (15 points).