PHY 6645 Fall 2003 – Homework 1

Due by 5 p.m. on Friday, September 5. No credit will be available for homework submitted after 5 p.m. on Monday, September 8.

Answer all questions. Please write neatly and include your name on the front page of your answers. You must also clearly identify all your collaborators on this assignment. To gain maximum credit you should explain your reasoning and show all working.

1. Determine whether each of the following sets constitutes a linear vector space when addition and scalar multiplication are defined in the standard fashion and scalar multiplication is taken over the field of real numbers. For each set that gives a vector space, determine the dimension of that space. For each of the remaining sets, list all the properties of a linear vector space that are violated.

    (a) The set of all linear combinations of 1, $\cos^2 x$, $\sin^2 x$, $\cos^4 x$, and $\sin^4 x$.

    (b) The set of all 2×2 real matrices that have an eigenvalue 0.

    (c) The set of all column vectors of length (dimension) 4 that have exactly two nonzero entries.

    (d) The set of all 3×3 real antisymmetric matrices.

    (e) The set of all real-valued, differentiable functions $f(x)$ that satisfy $df/dx \geq 0$ for all x.

2. Shankar Exercise 1.1.4.

3. Shankar Exercise 1.3.2.

4. Shankar Exercise 1.6.6.