Math 370 Problem Set #2 Due week of Jan. 27, 2014, in lab.

Read Hoffman and Kunze, Chapter 2, Sections 1 and 2.

1. From Hoffman and Kunze, do Chapter 1, pp. 26-27, do problems 1, 3, 4, 6, 8, 9.

2. From Hoffman and Kunze, Chapter 2, p. 34, do problems 6 and 7. Also, in problem 6, is V a vector space over the field of *complex* numbers?

3. a) Is $\mathbb{R}$ a vector space over the field $\mathbb{Q}$?
   b) Is $\mathbb{Q}$ a vector space over the field $\mathbb{R}$?
   c) Is the set of purely imaginary complex numbers a vector space over $\mathbb{R}$?
   d) Is the set of complex numbers of absolute value 1 a vector space over the field $\mathbb{R}$?
   e) Is the set of symmetric 3×3 real matrices (i.e. matrices with $a_{ij} = a_{ji}$ for all i, j) a vector space over $\mathbb{R}$?
   f) Is the set of invertible 3×3 real matrices a vector space over $\mathbb{R}$?

4. Which of the following is a field? If so, why? If not, why not?
   a) the set of 2×2 real matrices (under matrix addition and multiplication).
   b) the set of irrational real numbers (under addition and multiplication of real numbers).
   c) the set of complex numbers of the form $a+bi$ with a, b each rational (under addition and multiplication of complex numbers).
   d) the set $\mathbb{R}^2$ under the usual addition of vectors, and with multiplication defined by $(a, b) \cdot (c, d) = (ac - bd, ad + bc)$. (Hint: You've seen this one before!)