Mathematical Methods in Physics HW1

1. Which of these form a group? If they do, identify which element acts as the identity. If they do not, specify which group criteria they do not meet.
   - Integers with addition
   - Integers with multiplication
   - Rationals with addition
   - Rationals with multiplication
   - 3x3 matrices with arbitrary real elements with matrix multiplication
   - 3x3 matrices with arbitrary real elements with addition
   - Imaginary numbers with addition
   - Imaginary numbers with multiplication

2. Which of these form a field? If they do then identify the field ingredients. If they do not, identify which ingredients go wrong.
   - 2D rotations matrices with matrix addition and matrix multiplication
   - 2D diagonal matrices with real elements with matrix addition and matrix multiplication
   - 2D arbitrary with real elements with matrix addition and matrix multiplication

3. Which of these constitute a vector space? If they do, show that they do. If they don't, show why they don't.
   - An n-tuple of complex numbers over the field of real numbers
   - An n-tuple of imaginary numbers over the field of real numbers
   - An n-tuple of imaginary numbers over the field of complex numbers
   - An n-tuple of complex numbers over the field of imaginary numbers

4. Show that even and odd integers do not form a group under multiplication.

To be continued...