

Homework 1
289A Statistical mechanics of crystalline solids
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Question 1: Determine the point group operations of a two-dimensional triangular lattice (the \mathbf{a} and \mathbf{b} vectors of the lattice have the same length and the angle between them is 120°).

Make sure to determine the Cartesian 2×2 matrix representations for each point group operation you find. For each point group operation also identify the type of operation (mirror, inversion etc.).

Verify that the collection of symmetry operations you have found forms a group (e.g. by constructing a multiplication table).

Question 2: Determine the factor group of a two-dimensional honeycomb crystal (e.g. graphene). Note that a honeycomb grid is a triangular lattice with a two-atom basis. Also remember that factor group operations contain both a matrix and a translation vector.

First make a careful sketch of the honeycomb grid and also show the underlying triangular lattice. Then use your results from question 1 to determine the factor group operations as described in class.