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Problem sheet 8

8.1 Generation of the tetrahedral group

Modify your Mathematica script of problem 7.3 and generate all elements of the tetrahedral group T. Construct the group table. You may use the literature provided in stud.ip or stuff that you found elsewhere.

a. Which symmetries are described by the tetrahedral group? What is the order of the group? Which generating elements did you choose?

b. Try to find out, whether one can make general statements on the necessary number of generating elements. In the literature this problem runs under the key word *generating set of a group*. Is the number of generating elements given in Wagner's book really necessary?

c. Investigate the group T_d. Describe the symmetry transformations provided by T_d. Explain the difference compared to T.

d. Generate the group T_d with your Mathematica script with your favorite generating elements. How many did you need? What is the relation between T and T_d?

e. **Bonus problem:** Extend your Mathematica notebook and determine the conjugacy classes of T or T_d. How many did you find? How many elements are contained in the respective classes?

f. **Quintessence:** How do you like the following statement? One can generate a group from the symmetry operations of the problem under consideration in order to work with the group. (The opposite statement is problematic, since one cannot really know a priori how many generating elements are needed to generate the group.)