



KTH Teknikvetenskap

SF2723 Topics in Mathematics - Matrix groups
Homework Assignment 3
2008-09-17

The solutions should be handed in no later than September 24, 2008. The final grade will be based upon the total score on the homework and on the oral exam. The total maximal score on the homework assignments is 200 and in order to pass, at least 100 is required.

In order to get full score on each problem, the written presentation of the solution should be clear and the arguments easy to follow.

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1. Show that $\mathrm{Sl}_2(\mathbb{C}) = \mathrm{Sp}_2(\mathbb{C})$ and write all elements in these groups as products of transvections. **(3)**

 2. Let $k = \mathbb{F}_3$ be the field with three elements. Determine the number of elements of the special orthogonal groups, $\mathrm{SO}_n(k)$, for $n = 2$ and $n = 3$ and describe the elements of these groups. **(3)**

 3. In the cases of $k = \mathbb{F}_3$ and $k = \mathbb{F}_5$, determine the equivalence classes of symmetric non-degenerate bilinear forms, $\langle \cdot, \cdot \rangle$, on a three-dimensional vector space, V_k^3 . **(4)**

 4. In each of the equivalence classes of the previous problem, determine the order of $\mathrm{SO}(V_k^3, \langle \cdot, \cdot \rangle)$. **(4)**