

HOMEWORK 1 FOR 18.745, FALL 2012
DUE FRIDAY, SEPTEMBER 14 BY 3PM.

- (1) Prove that if k has characteristic 2 then $\mathfrak{sl}_2(k)$ is nilpotent.
- (2) Let k be a field of characteristic other than 2. Show that every two dimensional Lie algebra over k is either abelian or isomorphic to the Lie algebra of (non-strictly) upper triangular 2×2 matrices with zero trace. (In particular, there are exactly two isomorphism classes of two dimensional Lie algebras).
- (3) Let $\mathfrak{g} \subset \mathfrak{gl}_6(\mathbb{C})$ be the Lie subalgebra of strictly upper triangular matrices (a_{ij}) satisfying also $a_{12} = a_{34} = a_{56} = 0$. Describe the center of \mathfrak{g} .