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We classify seven dimensional Lie algebras that have a four-dimensional nilradical. It is shown that any such indecomposable algebra necessarily has an abelian nilradical. Accordingly the classification reduces to the problem of classifying three-dimensional pencils of four by four matrices with the property that no linear combination of the generators is nilpotent. We enumerate eight matrix Lie groups whose Lie algebras comprise the collection of seven-dimensional abelian nilradical algebras. In each case we list also a set of right-invariant vector fields, geodesic equations of the corresponding canonical connection and a Lagrangian that engenders the geodesics as Euler-Lagrange equations. (Received August 26, 2008)