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We study Liouville-type theorems for the time-dependent Navier-Stokes equations. In spatial dimension two, the situation is quite well understood and one can obtain results which are more or less optimal. In spatial dimension three the general problem is largely unsolved, and seems out of reach of present-day methods. In the case when solutions have certain symmetries, however, non-trivial results can still be obtained. Liouville theorems are closely related to questions about potential singularities, and we will explain how our results rule out certain types of singularities. (Received August 07, 2007)