It has occurred to me that the dimension of a system is equal to the number of variables minus the number of restrictions on the solution set. eg for a square system of equations the ~~so~~ dimension of soln set is ~~[illegible]~~ zero, since the set is just a set of points, and if no. of equations is less than no. of variables we use 1 dimension for each parameter we introduce.

However

$\text{Dim}(O(n)) = n^2$ $\quad$ $\det = \{1, -1\}$

$\text{Dim}(SO(n)) = n^2$ $\quad$ $\det = \{1\}$.

I thought that $\det = 1$ would be an extra condition in the same way that we might demand $Tr = 0$. Why isn't it? (I'm thinking of cardinal nos.) Because the dimension is defined as that of the tangent space at the identity. When you have a group consisting of disconnected pieces, only the piece connected to identity counts — & this is same for $O(n)$ as $SO(n)$.

T again, your answer starts here

From Linear Algebra

$\dim u(m,n) = \dim Tr\, u(m,n) + \dim \ker Tr(u(m,n))$

$\qquad = 1 + \dim Tr^{-1}(0)$

Thus $\dim Tr^{-1}(0) = \dim u(m,n) - 1$

$\qquad = (m+n)^2 - 1.$

And $Tr^{-1}(0)$ is tangent space of $su(m,n)$ since exp is a homomorphism from the tangent space to $SU(m,n)$

$Tr\, A = 0 \Leftrightarrow \det e^A = e^{Tr A} = 1 \Rightarrow e^A \in SU(m,n)$

$\Rightarrow Tr\, A = 0.$

show $AK + KA^T = 0$