5) Suppose $A, B \in SU(m,n)$

Then $AKA^+ = K$, $BKB^+ = K$

$BAKA^+B^+ = BKB^+ = K$

i.e. $(BA)K(BA)^+ = K$

and $ABKB^+A^+ = AKA^+ = K$

i.e. $(AB)K(AB)^+ = K$

$\therefore AB, BA \in SU(m,n)$

$IKI = K$ (by definition)

$I \in SU(m,n)$

If $A \in SU(m,n)$ then $AKA^+ = K$

det $A = 1$, $\therefore A^{-1}$ exists and $A^{-1}(AKA^+)$

$AKA^+ = K$

$\Rightarrow A^{-1}AKA^+A = A^{-1}KA$

what did you get this from?

NOT TRUE

WORSE

$\therefore SU(m,n)$ is a group (matrix multiplication)

ii) It is shown in part iii) that A is skew Hermitian along the diagonal blocks which form part of A $\therefore$ each element a_{ii} is purely complex and $Tr\,A$ is purely complex

do you really mean $|\det u| = 1$. Conditions added

Let $U(m,n)$ be the set of all complex matrices satisfying $uKu^+ = K$, with $|\det u| = 1$

Then if $u(m,n)$ is set of tangent vectors B to U we find still that $u(m,n)$ consists of matrices skew Hermitian along the diagonal blocks which form part of B, b_{ii} are purely imaginary.

$Tr\,u(m,n) = i\mathbb{R}$

NO - this already has all properties NOT all for u.

PTO