Maps between Lie groups

Let $G \subset \mathrm{GL}_m(\mathbb{R})$ and $H \subset \mathrm{GL}_n(\mathbb{R})$ be Lie groups. Let $\mathfrak{g}$ and $\mathfrak{h}$ be their Lie algebras. Let $\phi : G \to H$ be both

(1) a group homomorphism, meaning $\phi(\mathrm{Id}_m) = \mathrm{Id}_n$ and $\phi(g_1 g_2) = \phi(g_1)\phi(g_2)$.
(2) a smooth map, meaning there is an open set $U \supseteq G$ and a C^∞ function $\tilde{\phi} : U \to H$ such that $\tilde{\phi}$ restricts to ϕ on G.

We write $D\phi$ for the map $\mathfrak{g} \to \mathfrak{h}$ given by $D\tilde{\phi}$ restricted to $\mathfrak{g}$.

Problem 33. For $X \in \mathfrak{g}$, show that $\exp((D\phi)X) = \phi(\exp X)$.

Problem 34. For X and Y in $\mathfrak{g}$, show that $(D\phi)\Big([X, Y]\Big) = \Big[(D\phi)(X),\ (D\phi)(Y)\Big]$.