4. For each of the following classical Lie algebras $\mathfrak{g}$ over the field $\mathbb{C}$ prove that the derived subalgebra $\mathfrak{g}'$ of $\mathfrak{g}$ coincides with $\mathfrak{g}$, i.e. $\mathfrak{g}' = \mathfrak{g}$ as vector spaces:

   (i) $\mathfrak{g} = \mathfrak{sl}_n\mathbb{C}$, the special linear Lie algebra with $n = 3$.
   (ii) $\mathfrak{g} = \mathfrak{so}_n\mathbb{C}$, the orthogonal Lie algebra with $n = 4$.
   (iii) $\mathfrak{g} = \mathfrak{sp}_{2n}\mathbb{C}$, the symplectic Lie algebra with $n = 2$.

5. For $n \geqslant 1$ prove that the derived subalgebra $\mathfrak{g}'$ of the general linear Lie algebra $\mathfrak{g} = \mathfrak{gl}_n\mathbb{C}$ coincides with the special linear Lie algebra $\mathfrak{sl}_n\mathbb{C}$, i.e. $\mathfrak{g}' = \mathfrak{sl}_n\mathbb{C}$ as vector subspaces of $\mathfrak{g}$. *Hint:* use an appropriate basis of the vector space $\mathfrak{g}$.