11. For each of the following classical Lie algebras $\mathfrak{g}$ over $\mathbb{C}$ prove that the *centre* of $\mathfrak{g}$ consists of the zero element only: if $[Z, X] = 0$ for every $X \in \mathfrak{g}$, then $Z = 0$.

(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 $n = 4$.

12. Let $\mathfrak{g}$ be the *two-dimensional non-Abelian* Lie algebra over the field $\mathbb{C}$. It has two basis vectors E and F with the commutation relation $[E, F] = E$. Take any element $X = aE + bF \in \mathfrak{g}$ with $a, b \in \mathbb{C}$. Compute the matrix of the linear operator $\mathrm{ad}_X : Y \mapsto [X, Y]$ in $\mathfrak{g}$ relative to the basis E, F.