1. Consider the following $2 \times 2$ “normal” matrix ($NN^\dagger = N^\dagger N$) in terms of real constants $a$, $b$, $\beta$, and $\gamma$.

$$N = \begin{pmatrix} a & be^{i\beta} \\ be^{i\gamma} & a \end{pmatrix}.$$ 

(a) Find the eigenvalues $\lambda_i$ and eigenvectors $v_i$

$$Nv_i = \lambda_i v_i.$$ 

(b) Show that

$$N^\dagger v_i = \lambda_i^* v_i.$$ 

(c) Find the relationships between the constants for the case that $N$ is Hermitian.

(d) Find the relationships between the constants for the case that $N$ is unitary.