

Consider the following matrix

$$\begin{pmatrix} 1 & 3 \\ 3 & b \end{pmatrix}$$

Suppose that b is a (possibly complex) number. For each of the following, determine the most general conditions on b such that this matrix is:

- (a) symmetric
- (b) antisymmetric
- (c) orthogonal
- (d) normal
- (e) hermitian
- (f) unitary

In each case, explain your reasoning.

For the same matrix, but the special case $b = 1$,

- (g) determine the left eigenvectors
- (h) determine the right eigenvectors