

Mathematical Methods in Physics

Weekly Problems 3

3.1

Consider the matrix

$$A = \begin{pmatrix} 0 & -i & i \\ i & 0 & -i \\ -i & i & 0 \end{pmatrix}.$$

Is it (i) Hermitian, (ii) anti-Hermitian i.e. $A^\dagger = -A$, (iii) singular, (iv) unitary?

3.2

Find a transformation that diagonalise the following matrix, that is find D , S and S^{-1} such that $D = S^{-1}AS$

$$\begin{pmatrix} 2 & -2 \\ 1 & 4 \end{pmatrix}.$$

3.3

Consider the matrix $B = \begin{pmatrix} -1 & 1 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$.

- What kind of special matrix is matrix B ? Find its eigenvalues and eigenvectors. Choose the eigenvectors in such a way that they form an orthonormal set of vectors (i.e. they need to be unit vectors, mutually orthogonal.)
- Diagonalize the matrix B , i.e find a matrix S such that $D = S^{-1}BS$ is diagonal.