

Eigenvalues and Eigenvectors

Each group will be assigned one of the following matrices. Find the eigenvalues and (un-normalized) eigenvectors of your matrix. When you are finished, write your solutions on the board. If you finish early, try another matrix with a different structure, i.e. real vs. complex entries, diagonal vs. non-diagonal, 2×2 vs. 3×3 , with vs. without explicit dimensions.

$$A_1 \doteq \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \quad A_2 \doteq \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad A_3 \doteq \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$A_4 \doteq \begin{pmatrix} a & 0 \\ 0 & d \end{pmatrix} \quad A_5 \doteq \begin{pmatrix} 3 & 1 \\ 1 & 3 \end{pmatrix} \quad A_6 \doteq \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} \quad A_7 \doteq \begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix}$$

$$A_8 \doteq \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{pmatrix} \quad A_9 \doteq \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$S_x \doteq \frac{\hbar}{2} \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad S_y \doteq \frac{\hbar}{2} \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad S_z \doteq \frac{\hbar}{2} \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$