Problem 1. For each of the A matrices shown below, find the eigenvalues and eigenvectors (and generalized eigenvectors, if necessary) of the A matrix (using Matlab, preferably), construct the modal matrix M, and put the matrix in Jordan (or diagonal) form.

\[
\begin{align*}
\text{a. } A & = \begin{bmatrix} -1 & 1 \\ 2 & 2 \end{bmatrix} \\
\text{b. } A & = \begin{bmatrix} -3 & 1 \\ 0 & -3 \end{bmatrix} \\
\text{c. } A & = \begin{bmatrix} -10 & 0 & -10 & 0 \\ 0 & -0.7 & 9 & 0 \\ 0 & -1 & -0.7 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \\
\text{d. } A & = \begin{bmatrix} 7 & 2 & 2 & 0 \\ -2 & 2 & -1 & 0 \\ -7 & -4 & 0 & 1 \\ 2 & 1 & 1 & 3 \end{bmatrix}
\end{align*}
\]

Note: These particular cases were chosen because they illustrate all three cases that are typically of interest in control system analysis: a real, distinct eigenvalue case, two repeated (real) eigenvalue/Jordan form cases, and a case with complex eigenvalues. If you can handle these three cases, you basically can find the modal matrix and the Jordan form (and the things we will derive from them) for any A matrix that you might encounter in control systems analysis.