1. Compute $e^A$, where $A = \begin{bmatrix} 1 & 1 \\ -2 & 4 \end{bmatrix}$.

2. Suppose there are four teams in a league. At the end of the season, the results are as follows:

   Team 1 beat teams 2 and 3, but lost to team 4.
   Team 2 beat team 3, but lost to teams 1 and 2.
   Team 3 beat team 4, but lost to teams 1 and 2.
   Team 4 beat teams 1 and 2, but lost to team 3.

(a) Form the corresponding matrix $A$ that reflects these results.

(b) How small can the dominant eigenvalue for $A$ be? How large? Explain.

(c) It turns out that the dominant eigenvalue is approximately 1.395, and the corresponding eigenvector is $v = \begin{bmatrix} 0.552 \\ 0.321 \\ 0.448 \\ 0.626 \end{bmatrix}$. How should the teams be ranked?

3. Find a diagonal matrix $D$ and an orthogonal matrix $P$ so that $D = P^T A P$, where

$$A = \begin{bmatrix} 0 & 0 & -2 \\ 0 & -2 & 0 \\ -2 & 0 & 3 \end{bmatrix}.$$