Answer the following questions about the linear system assigned to you.

- Groups 1,5: \( A = \begin{bmatrix} 1 & -3 \\ 1 & 1 \end{bmatrix} \)

- Groups 2,6: \( B = \begin{bmatrix} -1 & -3 \\ 1 & -1 \end{bmatrix} \)

- Group 3: \( C = \begin{bmatrix} 1 & -3 \\ 1 & -1 \end{bmatrix} \)

- Group 4: \( D = \begin{bmatrix} -1 & 5 \\ -1 & -1 \end{bmatrix} \)

1. Find all the complex eigenvalues.

2. Pick one eigenvalue \( \lambda \) and find a corresponding eigenvector \( \vec{v} \).

3. Use Euler’s formula to write out the complex-valued solution to the system \( \vec{Y}(t) = e^{\lambda t} \vec{v} \)

4. Decompose \( \vec{Y}(t) = e^{\lambda t} \vec{v} \) into \( \vec{Y}(t) = \vec{Y}_{re}(t) + \vec{Y}_{im}(t) \)
5. Check that $\vec{Y}_{re}(0)$ and $\vec{Y}_{im}(0)$ are linearly independent vectors in $\mathbb{R}^2$. What can you conclude about $\vec{Y}_{re}(t)$ and $\vec{Y}_{im}(t)$?

6. Write the general solution to the system

7. Use Matlab to graph the phase plane and several solutions to your system. Do you think the origin is a sink, source, or neither?