

## Part II Problems

**Problem 1:** [Eigenvalues, eigenvectors] **(a)** Find the eigenvalues and eigenvectors of the companion matrix for  $\ddot{x} + 4\dot{x} + 3x = 0$ . On the  $x, y$  plane draw the eigenlines. For each of the two eigenlines, write down a solution which moves along it. Compare this with the work you did on the part II problem in the previous session.

**(b)** Find the eigenvalues and eigenvectors of the matrix  $A = \begin{bmatrix} 2 & -4 \\ 1 & -3 \end{bmatrix}$ . Sketch the eigenlines, and for each eigenline write down all the solutions whose trajectories lie on that line.

**(c)** Now, invoke Linear Phase Portraits: Matrix Entry again, set  $a, b, c,$  and  $d$  to display the phase plane for this matrix, and sketch the phase plane that it displays. Make sure to include (by clicking on the phase plane) at least one trajectory in each wedge between eigenlines. Include arrows indicating the direction of time.

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