

Phase portraits for linear systems with real nonzero eigenvalues

For each of the following,

- construct the general solution of the system using the given eigenstuff.
- sketch a phase portrait using the general solution

1. $\frac{d\vec{Y}}{dt} = A\vec{Y}$ where $A = \begin{bmatrix} 1 & -2 \\ 1 & 4 \end{bmatrix}$

eigenvalue $\lambda_1 = 2$ with eigenvector $\vec{v}_1 = \begin{bmatrix} 2 \\ -1 \end{bmatrix}$

Eigenstuff for A :

eigenvalue $\lambda_2 = 3$ with eigenvector $\vec{v}_2 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$

2. $\frac{d\vec{Y}}{dt} = A\vec{Y}$ where $A = \begin{bmatrix} 3 & -1 \\ 5 & -3 \end{bmatrix}$

eigenvalue $\lambda_1 = -2$ with eigenvector $\vec{v}_1 = \begin{bmatrix} 1 \\ 5 \end{bmatrix}$

Eigenstuff for A :

eigenvalue $\lambda_2 = 2$ with eigenvector $\vec{v}_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$

3. $\frac{d\vec{Y}}{dt} = A\vec{Y}$ where $A = \begin{bmatrix} -5 & 4 \\ -2 & 1 \end{bmatrix}$

eigenvalue $\lambda_1 = -3$ with eigenvector $\vec{v}_1 = \begin{bmatrix} 2 \\ 1 \end{bmatrix}$

Eigenstuff for A :

eigenvalue $\lambda_2 = -1$ with eigenvector $\vec{v}_2 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$