

7. [12 points] Suppose that the matrix \mathbf{A} has eigenvalues $\lambda = -1$ and $\lambda = -2$, with corresponding eigenvectors $\mathbf{v}_{-1} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ and $\mathbf{v}_{-2} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$. If the solution to $\mathbf{Ax} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}$ is $\mathbf{x} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$, sketch the phase portrait for the system $\mathbf{x}' = \mathbf{Ax} + \begin{pmatrix} -2 \\ 2 \end{pmatrix}$. Explain how you get your answer.