For the autonomous linear system $\frac{d\mathbf{Y}}{dt} = \mathbf{AY}$ with $\mathbf{A} = \begin{pmatrix} -2 & -2 \\ -2 & 1 \end{pmatrix}$ and $\mathbf{Y} = \begin{pmatrix} x \\ y \end{pmatrix}$, compute the general solution by completing the following steps.

Problem 1: (2 points) Compute the eigenvalues of $\mathbf{A}$.

Problem 2: (2 points) For each eigenvalue of $\mathbf{A}$, find an associated eigenvector.

Problem 3: (2 points) What is the general solution to the autonomous linear system $\frac{d\mathbf{Y}}{dt} = \mathbf{AY}$ with $\mathbf{A} = \begin{pmatrix} -2 & -2 \\ -2 & 1 \end{pmatrix}$ and $\mathbf{Y} = \begin{pmatrix} x \\ y \end{pmatrix}$?

Problem 4: (2 points) Is the equilibrium at the origin a *source*, a *sink*, a *saddle*, or *none of these*? Are there any other equilibrium to the system? How do you know?

Problem 5: (2 points) Sketch the phase portrait for the system.