1. Let \( A = \begin{pmatrix} -2 & -8 \\ 2 & 6 \end{pmatrix} \). Find an invertible matrix \( S \) and a matrix \( B \) in Jordan-normal form such that \( A = SBS^{-1} \).

The characteristic polynomial is
\[
\det \left( \begin{array}{cc} -2 - t & -8 \\ 2 & 6 - t \end{array} \right) = (-2 - t)(6 - t) + 16 = t^2 - 4t + 4 = (t - 2)^2.
\]

Since there is a double root and \( A \) is not already diagonal, \( A \) is not diagonalizable. This tells us that
\[
B = \begin{pmatrix} 2 & 1 \\ 0 & 2 \end{pmatrix}.
\]

To find \( S \), we compute the matrix
\[
N = A - 2I = \begin{pmatrix} -4 & -8 \\ 2 & 4 \end{pmatrix}.
\]

Since the last column of \( N \) is not zero, we let \( v_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix} \) and
\[
v_1 = Nv_2 = \begin{pmatrix} -8 \\ 4 \end{pmatrix}.
\]

The columns of \( S \) are given by \( v_1 \) and \( v_2 \):
\[
S = \begin{pmatrix} -8 & 0 \\ 4 & 1 \end{pmatrix}.
\]