5. [10 points] Consider the linear system

\[
\begin{pmatrix} x \\ y \\ z \end{pmatrix}' = \begin{pmatrix} -1 & 0 & \alpha^2 \\ 0 & -2 & 2 \\ 1 & 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \end{pmatrix}.
\]

a. [5 points] For what values of \( \alpha \), if any, will all solutions to the system remain bounded as \( t \to \infty \)?

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Possibly useful:

\[
\det\begin{pmatrix} a & 0 & b \\ 0 & c & d \\ e & 0 & f \end{pmatrix} = acf - bce.
\]

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b. [5 points] Now suppose that \( \alpha = 2 \). Are there any initial conditions for which solutions to the system will remain bounded? If so, what are they? Explain.