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 α, if any, will all solutions to the system remain bounded as $t \to \infty$?[1]

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.

[1] *Possibly useful:* $\det\left(\begin{pmatrix} a & 0 & b \\ 0 & c & d \\ e & 0 & f \end{pmatrix}\right) = acf - bce$.