Q1a: The matrix $A = \begin{pmatrix} 0 & 0 & a \\ 0 & b & 0 \\ a & 0 & 0 \end{pmatrix}$ will have eigenvalues of $\lambda_1 = -a$ coresonding to $v_1 = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}$, $\lambda_2 = b$ corresponding to $v_2 = \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ and $\lambda_3 = a$ corresponding to $v_3 = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix}$. Therefore this will have a general solution of $x(t) = \alpha_1 e^{-at} \cdot v_1 + \alpha_2 e^{bt} \cdot v_2 + \alpha_3 e^{at} \cdot v_3$ for some constants $\alpha_1, \alpha_2, \alpha_3 \in \mathbb{R}$ which will depend on the inital conditions of this system.