Consider the following matrix:

$$A = \begin{pmatrix} 3 & 0 \\ -1 & 2 \end{pmatrix}$$

(a) Plot the unit circle and the unit circle under A on the same set of axes

(b) Plot the eigenvectors of A. Include the unit eigenvector and the eigenvector scaled by its eigenvalue

(c) In the singular value decomposition, the first column of U is a "singular vector." Use your preferred linear algebra package to compute the singular value decomposition of A. Plot the first singular vector as a unit vector and scaled by the matrix A

(d) How does A act differently on its eigenvectors versus its singular vectors? What does this tell you about the relationship between eigenvalues and singular values?