

1. Let $A = \begin{bmatrix} -1 & 2 & 2 \\ -1 & -4 & -2 \\ -3 & 9 & 7 \end{bmatrix}$.
 - (a) Find the eigenvalues and eigenvectors of A by hand.
 - (b) Use the power method by hand with initial guess $v_0 = (1, 0, 0)$ to find v_1 and λ_1 , an approximation to the dominant eigenvector and eigenvalue.
 - (c) Use the inverse power method by hand with $\alpha = 0$ and with initial guess $v_0 = (1, 0, 0)$ to find v_1 , an approximation to the eigenvector corresponding to the smallest eigenvalue.
 - (d) Use the inverse power method by hand with $\alpha = -1$ and with initial guess $v_0 = (1, 0, 0)$ to find v_1 , an approximation to the eigenvector with corresponding eigenvalue closest to -1 .
2. Let $A = \begin{bmatrix} -1 & 2 & 2 \\ -1 & -4 & -2 \\ -3 & 9 & 7 \end{bmatrix}$.
 - (a) Use the power method with initial guess $v_0 = (1, 0, 0)$ to find v_{11} and λ_{11} .
 - (b) Use the inverse power method with $\alpha = 0$ and with initial guess $v_0 = (1, 0, 0)$ to find v_9 and λ_9 .
 - (c) Use the inverse power method with $\alpha = -1.7$ and with initial guess $v_0 = (1, 0, 0)$ to find v_8 and λ_8 .
3. Let $A = \begin{bmatrix} 7 & 4 \\ 3 & 6 \end{bmatrix}$.
 - (a) Find the eigenvalues and eigenvectors of A by hand.
 - (b) Use the power method by hand with initial guess $v_0 = (1, 1)$ to find v_1 and λ_1 , an approximation to the dominant eigenvector and eigenvalue.
 - (c) Use the inverse power method by hand with $\alpha = 0$ and with initial guess $v_0 = (1, 1)$ to find v_1 and λ_1 , an approximation to the smallest eigenvalue and its corresponding eigenvalue.
4. Let $A = \begin{bmatrix} 7 & 4 \\ 3 & 6 \end{bmatrix}$.
 - (a) Use the power method by hand with initial guess $v_0 = (1, 1)$ to find v_{18} and λ_{18} , an approximation to the dominant eigenvector and eigenvalue.
 - (b) Use the inverse power method by hand with $\alpha = 0$ and with initial guess $v_0 = (1, 1)$ to find v_{13} and λ_{13} , an approximation to the smallest eigenvalue and its corresponding eigenvector.
5. Find the singular values of each of the following matrices.
 - (a) $A = \begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$
 - (b) $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$
 - (c) $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$
6. Find the SVD of each of the following matrices.
 - (a) $A = \begin{bmatrix} 1 & 0 \\ 0 & -2 \end{bmatrix}$
 - (b) $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$
 - (c) $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \end{bmatrix}$
7. textbook exercises: 2, 3.