Consider the matrix

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

1. Find the eigenvalues and eigenvectors of A.
2. Let P be the matrix with the eigenvectors for A as its columns. Compute AP.
3. Compare the columns of P and the columns of AP. What do you notice?
4. Let D be the diagonal matrix whose entries are the eigenvalues of A, in the order corresponding to the order that the eigenvectors appear in the columns of P. Compute PD. What do you notice?