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?