Consider the matrix A

$$\begin{bmatrix} 0 & 0 & 8 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

over real numbers.

(1) Compute its characteristic polynomial, and factor it as much as possible. (Remember that we are over reals)
(2) Find an eigenvector v_1
(3) Find a vector in the kernel of $A^2 + 2A + 4$, and call it v_2.
(4) Write matrix A with respect to basis v_1, v_2, Av_2
(5) Now work over complex numbers. Find an eigenbasis and use it to diagonalize the matrix.