Eigenvalues and eigenvectors of square matrices can be found with the command `eig`. If \( A \) is a square matrix \( d = \text{eig}(A) \) produces a vector containing the eigenvalues of \( A \) and \([V, D] = \text{eig}(A)\) produces a diagonal matrix \( D \) of eigenvalues and a matrix \( V \) whose columns are the corresponding eigenvectors so that \( A * V = V * D \).

1. Ex. 33, p.326, Lay. Call the matrix \( A \). We will do the problem in two ways:
   (a) Do \( d = \text{eig}(A) \). Then find the eigenvectors by row reduction, i.e. do \( R = \text{rref}(A - d(1) * \text{eye}(4)) \), etc. If you have vectors \( p_1, p_2, p_3, p_4 \), to form them into a matrix \( P \), write \( P = [p_1 \ p_2 \ p_3 \ p_4] \). Then check that \( P * \text{diag}(d) * \text{inv}(P) = A \).
   (b) Do \([V, D] = \text{eig}(A)\) and check that \( A = V * D * \text{inv}(V) \). Note that \( V \) and \( P \) from part (a) may be quite different.

2. Ex. 15, p.341, Lay. Call the matrix \( B \). Do \([V, D] = \text{eig}(B)\). Then take
   \[ P = [\text{real}((V(:,1)) \ \text{imag}((V(:,1))] \]
   and check that \( \text{inv}(P) * B * P \) has the correct form.

3. (a) Find the general solution of \( x' = Ax \), where
   \[ A = \begin{pmatrix} 3 & -1 & -6 & 0 \\ 0 & 4 & 2 & 6 \\ 3 & -3 & -7 & -3 \\ -5 & 3 & 10 & 2 \end{pmatrix} \]
   (b) Find the solution of the initial value problem \( x' = Ax \), \( x(0) = x_0 \) where \( x_0 = (1, 2, -1, 3)^T \). Your result should involve vectors with integer entries.
   Note: To get the \( k^{th} \) column vector of a matrix \( V \) write \( V(:, k) \).

4. The solution of \( x' = Ax \), \( x(0) = (1,0)^T \) where \( A \) is the matrix of Ex. 14, p.361 is given by
   \[ x_1 = \cos(2t) - \sin(2t), \quad x_2 = -4 \sin(2t) \].
   We wish to see what the trajectory of this solution looks like. So do
   \[ t = 0:.01:pi; x1 = \cos(2*t) - \sin(2*t); x2 = -4 * \sin(2*t); \text{plot}(x1, x2) \]
   Use the command \textbf{print} to print out the resulting graph. Remember that you cannot save the graph in your diary.