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 $A \cdot V = V \cdot D$.

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 $R = \text{rref}(A - d(1) \cdot \text{eye}(4))$, 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 $P \cdot \text{diag}(d) \cdot \text{inv}(P) = A$.
   (b) Do $[V, D] = \text{eig}(A)$ and check that $A = V \cdot D \cdot \text{inv}(V)$. 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
   
   $$P = [\text{real}((V(:,1)) \ 	ext{imag}((V(:,1)))]$$

   and check that $\text{inv}(P) \cdot B \cdot P$ 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 $x_0 = (1, 2, -1, 3)^T$.
   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 `print` to print out the resulting graph. Remember that you cannot save the graph in your diary.