1. Let \( x_0 = 3 \) and \( y_0 = 1 \). Suppose the sequences \( x_n, y_n \) are such that

\[
x_n = 3x_{n-1} - 2y_{n-1}, \quad y_n = 4x_{n-1} + 9y_{n-1}
\]

for each \( n \geq 1 \). Determine each of \( x_n \) and \( y_n \) explicitly in terms of \( n \).

2. Show that the following matrix is diagonalisable.

\[
A = \begin{bmatrix}
7 & 1 & -7 \\
3 & 3 & -5 \\
3 & 1 & -3
\end{bmatrix}.
\]

3. Find the eigenvalues and the generalised eigenvectors of the matrix

\[
A = \begin{bmatrix}
2 & 1 & 0 \\
1 & 3 & -1 \\
0 & 1 & 2
\end{bmatrix}.
\]

4. Suppose that \( A \) is a \( 4 \times 4 \) matrix whose first two columns are linearly independent, its third column is equal to the first column and its last column is zero. Find a basis for both the column space and the null space of \( A \). Hint: \( Ae_3 = Ae_1 \) and \( Ae_4 = 0 \).

- This assignment is due by Thursday noon, either in class or else in my office.
- Write your name and course (Maths, TP, TSM) on the first page of your homework.
- NO LATE HOMEWORK WILL BE ACCEPTED.