**No Calculators, closed book, no lecture notes, no homework. Show steps.**

1. The block matrix system of equations
   \[
   \begin{bmatrix}
   A & 0 & 0 \\
   0 & I & -A^T \\
   -I & Y & 0 \\
   \end{bmatrix}
   \begin{bmatrix}
   x_i \\
   x_v \\
   x_d \\
   \end{bmatrix}
   =
   \begin{bmatrix}
   0 \\
   0 \\
   b \\
   \end{bmatrix}
   \]
   models a resistive electrical circuit with the vector \( x = [x_i, x_v, x_d]^T \) representing its circuit element currents, voltages, and the circuit graph node voltages with respect to a common “ground node” (Note that \( I \) is a unit sub-matrix). Without using any sub-matrix inverses, show the node voltages \( x_d \) are the solution to the system \( AY^T x_d = Ab \) (HINT: write out the three sub-matrix equations then eliminate \( x_i \) and \( x_v \) from the third sub-matrix equation).

2. For \( A = \begin{bmatrix} 1 & 5 \\ 3 & 17 \end{bmatrix} \) and \( b = \begin{bmatrix} 2 \\ 2 \end{bmatrix} \), find the solution \( x \) to \( A x = b \) by first finding a lower triangular matrix \( L \) and an upper triangular matrix \( U \) such that \( LU = A \), and then calculating \( x \) with a forward and back substitution process on the resulting system \( LU x = b \).