1. Given
\[
\begin{align*}
  x + y + z &= 3 \\
  x + y + 3z &= 2 \\
  -2x + y - z &= 4.
\end{align*}
\]
(a) Write the system of equations in the form of \( Ax = b \).
(b) Determine whether or not \( A \) is singular.
(c) Solve for \( x, y, z \) using Gaussian elimination with pivoting.
(d) Check your answer to (b) and (c) by calculating the \( LU \) factorization in Matlab (or Octave).

2. Consider the ordinary differential equation
\[
\frac{dy}{dx} = y(2y - 1)
\]
(a) Find the general solution of the following differential equation problem expressing \( y \) as a function of \( x \) with an unknown constant \( C \).
(b) Find the particular solution satisfying the initial conditions \( y(1) = 1 \).
(c) Find the particular solution satisfying the initial conditions \( y(-1) = -1 \).