1. Consider the following set of linear algebraic equations:

\[
\begin{align*}
    x_1 + 3x_2 + 2x_3 &= 1 \\
    2x_1 + 3x_2 + 4x_3 &= 6 \\
    3x_1 - 2x_2 + 2x_3 &= -1
\end{align*}
\]

(a). Manually (by hand) row-reduce this set of equations following the Gauss elimination procedure. How would you characterize the geometrical character of the solution in \(\mathbb{R}^3\)?

(b). Use demo9 posted on our class web site to check your results.

(c). Use the RowReduce function of Mathematica to check it yet again.

2. Consider the following boundary value (BV) problem:

\[
y''(x) = -\lambda^2 y(x), \quad y'(0) = 0, \quad y'(L) + 2y(L) = 0
\]

(a). Solve this by hand and find the possible nonzero solutions over the \(x\) interval \(0 \leq x \leq L\). What are the eigenfunctions and eigenvalues?

(b). Use Mathematica’s DSolve to tackle this same problem.