Exercises 2

Assigned: Sep. 23
Due: Oct. 7

For the hand assignments, show your work. For the MATLAB assignments, hand in both the MATLAB expression that computes the answer and the answer.

1. Solve the following system of linear equations, both by hand and in MATLAB.
\[
\begin{align*}
x + y + z &= 0 \\
2x - y - z &= 2 \\
-x + y - z &= 2
\end{align*}
\]

2. By hand, characterize the space of solutions to the following systems of linear equations (somewhat surprisingly, MATLAB does not provide a one-step method for doing this).
\[
\begin{align*}
x + y - z &= 1 \\
x + y + z &= 3
\end{align*}
\]

3. What is the dimension of the space spanned by the following four vectors? (Do this both by hand and using MATLAB)
\[
\langle 1, 2, 2, -1 \rangle, \langle 0, 1, -1, 0 \rangle, \langle 1, 4, 0, -1 \rangle, \langle 2, 1, 1, -1 \rangle.
\]

4. Let \( V = \text{Span}((1, 1, 0, 3); (2, 4, -3, 1); (7, 9, -6, 5)) \). Using MATLAB, determine whether the vector \( (1, 3, -4, 0) \) is in \( V \).

5. Let \( V \) be the same as in exercise 4. Using MATLAB, find an orthogonal basis for the orthogonal complement of \( V \). (It is not necessary to implement the Gram-Schmidt orthogonalization algorithm.)