In Class Practice Problems

1) The upward velocity of a rocket is given at three different times in the following table

Table 1. Velocity vs. Time Data.

Time, t (s)	Velocity, v (m/s)
5	106.8
8	177.2
12	279.2

The velocity data is approximated by a polynomial as

$$v(t) = a_1 t^2 + a_2 t + a_3, \qquad 5 \le t \le 12$$

Find the values of a_1, a_2, and a_3 by completing six iterations of the Gauss-Seidel method. Calculate the absolute, relative, approximate percent error after each iteration. Show your results in a table. **NOTE:** *It is ok if the system of equations is not diagonally dominant, I want you to focus on correctly setting-up the system of equations and using Python to solve this problem*. Assume an initial guess of the solution as

$$\begin{bmatrix} a_1 \\ a_2 \\ a_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 5 \end{bmatrix}$$

2) Set up a non-singular 3-, 7-, 9-, and 11- equation system (i.e., four different equation systems).
   a) Solve each system of equations using LU Decomposition, Cramer's Rule, and the Gauss-Seidel method.
   b) Verify the solution accuracy of each method by calculating the residual vector, $\vec{r} = A\vec{x} - \vec{b}$, it should be zero or near zero.
   c) Time each method.
   d) Make a table showing the solution, residual, and time for each method and system of equations.