Problem 1   Given

$$A = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

find A^{10}, A^{103}, and e^{At}.

Problem 2   Find the least square solutions of $Ax = b$, where

$$A = \begin{pmatrix} 2 & 0 \\ -1 & 1 \\ 0 & 2 \end{pmatrix} \qquad b = \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}$$

What is the quantity being minimized?

Problem 3   Suppose that we have measured three data points

$$(0,6), \quad (1,0), \quad (2,0)$$

and our model is linear, compute the line of best fit by the method of least squares.

Problem 4   Find the minimal polynomial for the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & -2 \\ 0 & 1 & 3 \end{bmatrix}$

Problem 5   Find the parabola that best approximates the data points,

$$(-1, 1/2), \quad (1, -1), \quad (2, -1/2), \quad (3, 2)$$

What is the quantity being minimized?