1. Let

$$A = \begin{pmatrix} 1 & 0 \\ 1 & 3 \\ 1 & 6 \end{pmatrix}, \qquad \vec{b} = \begin{pmatrix} 1 \\ 4 \\ 5 \end{pmatrix}.$$

(a) Project $\vec{b}$ onto the $C(A)$ by solving $A^T A\vec{x} = A^T\vec{b}$ and $\vec{p} = A\vec{x}$. Show all steps. *[5 points]*

(b) Write down an analytical expression for the projection matrix P. (Note: you do not have to numerically evaluate/solve for the matrix.) *[1 point]*

(c) Find the error vector $\vec{e} = \vec{b} - \vec{p}$ and compute its dot product with the columns of A. What does this tell you about the relationship between $\vec{e}$ and the columns of A? *[4 points]*.