1. Consider the basis \( B = \{1 - x^2, 2 + 4x + x^2, -4x - 2x^2\} \) of the space of polynomials with degree less than or equal to 2 with real coefficients, \( \mathcal{P}_2 \). Find the coordinates of \( x^2 + x + 1 \) in this basis.

2. Consider the linear transformation \( T : M_{2 \times 2} \to M_{2 \times 2} \) given by \( T(A) = BA \) where \( B \) is the matrix

\[
B = \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix}
\]

Calculate the matrix of \( T \) with respect to the standard basis for \( M_{2 \times 2} \), i.e., the basis

\[
\left\{ \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix}, \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} \right\}.
\]