1. Consider the vectors
   \[ \mathbf{v}_1 = (2, 1, -3) \]
   \[ \mathbf{v}_2 = (1, 1, 1) \]
   \[ \mathbf{v}_3 = (-4, 5, -1). \]
   
   (a) Are \( \mathbf{v}_1 \), \( \mathbf{v}_2 \) and \( \mathbf{v}_3 \) orthogonal?
   
   (b) Prove that \( \mathbf{v}_1 \), \( \mathbf{v}_2 \) and \( \mathbf{v}_3 \) form a basis for \( \mathbb{R}^3 \).
   
   (c) Find the coordinates of the vector \( (1, 2, 3) \) in this basis.
   
   (d) Let \( A = \begin{pmatrix} 2 & 1 \\ 1 & 1 \\ -3 & 1 \end{pmatrix} \). Compute the matrix \( A^T A \).
   
   (e) Find the least-squares best fit line for the points \( (2, 0) \), \( (1, 1) \) and \( (-3, 3) \).