

1. Let \mathbf{x} and \mathbf{y} be two vectors in \mathbf{R}^n . Consider a line L given by parametric equation $\mathbf{y} + t\mathbf{x}$, $-\infty < t < \infty$.
 - (a) For a vector $\mathbf{a} \in \mathbf{R}^n$ find the orthogonal projection \mathbf{a}_p of the vector \mathbf{a} on the line L (i.e. find $\mathbf{a}_p \in \mathbf{R}^n$ such that $\mathbf{x}^T \mathbf{a}_p = 0$, and $\mathbf{a}_p = \mathbf{y} + t\mathbf{x}$ for some t whose value should be identified).
 - (b) Find a vector \mathbf{z} so that
 - i. $\mathbf{z}^T \mathbf{x} = 0$,
 - ii. the lines $\mathbf{z} + t\mathbf{x}$ and $\mathbf{y} + t\mathbf{x}$ are identical.
 - (c) Find the orthogonal projection \mathbf{a}_p of the vector \mathbf{a} on the line L if $\mathbf{y}^T \mathbf{x} = 0$, and $\mathbf{x}^T \mathbf{x} = 1$.