Let $V$ be a finite dimensional inner product space and $T$ a linear operator on $V$.

(a) Prove that null($T^*T$) = null($T$).

(b) Prove that dim null($T^*$) = dim null($T$).

(c) Prove or give a counterexample: null($T^*$) = null($T$).

(d) Use part (b) to show that $\lambda \in \mathbb{F}$ is an eigenvalue of $T$ if and only if $\bar{\lambda}$ is an eigenvalue of $T^*$.