8. (a) Explain what is meant by a *subspace* of the vector space $\mathbb{R}^n$. Describe the possible subspaces of $\mathbb{R}^3$. [3]

(b) Let $\underline{v} = (1, 1, 1)$ and $\underline{w} = (2, -1, 1)$, and define two subspaces V and W of $\mathbb{R}^3$ as:

$$V = \{\underline{u} \,:\, \underline{u}.\underline{v} = 0\} \qquad\qquad W = \{\underline{u} \,:\, \underline{u}.\underline{w} = 0\}$$

i. Find a basis for the subspace X that is the intersection of subspaces V and W. [4]

ii. What are the dimensions of the subspaces V, W, and X? [3]