DGD 2

Q1. Consider $\mathbb{R}^4$ with the standard operations. For each of the following sets, determine which of the first four vector space axioms it satisfies. Justify your answer.

$A = \{(a, b, c, d) : ab = 0\}$

$B = \{(a, b, c, d) : a = 1, b = 0, c + d = 1\}$

$C = \{(a, b, c, d) : a > 0, b < 0\}$

$D = \{(a, b, c, d) : a > 0, b > 0\}$

$E = \{(a, b, c, d) : a + b + c + d = 0\}$

Q2. Let V be a vector space. Let $a \in \mathbb{R}$ and let $\mathbf{u} \in V$. Prove each of the following statements using the vector space axioms.

a) $a\mathbf{0} = \mathbf{0}$.

b) If $a\mathbf{u} = \mathbf{0}$, then $a = 0$ or $\mathbf{u} = \mathbf{0}$.

c) $0\mathbf{u} = \mathbf{0}$.

d) $(-1)\mathbf{u} = -\mathbf{u}$.