Name: ______________________________

Directions: Show all work. No credit for answers without work.

1. Let V be the set of all positive real numbers; define $\oplus$ so that $\mathbf{u} \oplus \mathbf{v} = \mathbf{uv}$ (standard multiplication of reals) and $\odot$ so that $c \odot \mathbf{u} = \mathbf{u}^c$. It can be shown that V is a vector space.

   (a) [**1 point**] Identify the zero vector of V. (Your answer should be a specific element in V.)

   (b) [**3 points**] Prove that $c \odot (\mathbf{u} \oplus \mathbf{v}) = (c \odot \mathbf{u}) \oplus (c \odot \mathbf{v})$.

2. [**2 parts, 3 points each**] Determine if the given subsets of $\mathbb{R}^3$ are subspaces. Justify your answers.

   (a) $W = \left\{ \begin{bmatrix} a \\ b \\ c \end{bmatrix} : a + b + c = 1 \right\}$

   (b) $W = \left\{ \begin{bmatrix} a \\ b \\ c \end{bmatrix} : abc = 0 \right\}$