1. Find the 3-volume of the 3-parallelepiped defined by the vectors

$$v_1 = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}, \quad v_2 = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}, \quad v_3 = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \end{bmatrix}$$

2. Write down the set of eigenvalues for the following linear transforms.
(a) Reflection about the y-axis in $\mathbb{R}^2$. *Hint:* It's associated with the matrix $A = \left[\begin{smallmatrix} -1 & 0 \\ 0 & 1 \end{smallmatrix}\right]$.
(b) Reflection about the xy-plane in $\mathbb{R}^3$.
(c) Reflection about a plane $V = \{x \in \mathbb{R}^3 : n^T x = 0\}$ in $\mathbb{R}^3$; here $n \in \mathbb{R}^3$ is the unit normal vector of the plane.
(d) Orthogonal projection onto a plane $V = \{x \in \mathbb{R}^3 : n^T x = 0\}$ in $\mathbb{R}^3$; here $n \in \mathbb{R}^3$ is the unit normal vector of the plane.

3. **(Bonus, 4 points)** Find the eigenvectors corresponding to the eigenvalues of the linear transformations in the above problem.