3) World Coordinate frame: $[1,1,1]$

Camera coordinate frame:

$$\beta = (M^T)^{-1} \alpha \qquad \alpha = [1,1,1,0]^T$$

$$\beta = \frac{-1}{2} \begin{bmatrix} 0 & e & -2 & 6 \\ \frac{e}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 & \frac{6}{\sqrt{2}} \\ -\sqrt{2} & -\sqrt{2} & 0 & 3\sqrt{2} \\ 0 & 0 & 0 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \end{bmatrix}$$

$$\beta = \begin{bmatrix} -1 \\ 0 \\ -\sqrt{2} \\ 0 \end{bmatrix}$$