44

$p = [3, 0, 0]$

$- P' = (T_3 \cdot T_2 \cdot T_1)\, p$

$$P' = \begin{bmatrix} \cos 45 & \sin 45 & 0 & 0 \\ -\sin 45 & \cos 45 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -9 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 90 & \sin 90 & 0 \\ 0 & -\sin 90 & \cos 90 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$P' = \begin{bmatrix} \sqrt{2}/2 & \frac{\sqrt{2}}{2} & 0 & -5\sqrt{2}/2 \\ -\sqrt{2}/2 & \frac{\sqrt{2}}{2} & 0 & 13\sqrt{2}/2 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos 90 & \sin 90 & 0 \\ 0 & -\sin 90 & \cos 90 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$P' = \begin{bmatrix} \frac{\sqrt{2}}{2} & 0 & \frac{\sqrt{2}}{2} & \frac{-5\sqrt{2}}{2} \\ +\frac{\sqrt{2}}{2} & 0 & \frac{\sqrt{2}}{2} & \frac{13\sqrt{2}}{2} \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} \frac{3\sqrt{2}}{2} \\ +\frac{3\sqrt{2}}{2} \\ 0 \\ 0 \end{bmatrix}$$

$- P' = (T_1 \cdot T_2 \cdot T_3)\, p$

$$P' = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -9 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \sqrt{2}/2 & \sqrt{2}/2 & 0 & 0 \\ -\sqrt{2}/2 & \sqrt{2}/2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & -9 \\ 0 & 0 & 1 & 3 \\ 0 & -1 & 0 & -4 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 0 & -9 \\ 0 & 0 & 1 & 3 \\ \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0 & -4 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 0 \\ 0 \end{bmatrix} =$$

$$= \begin{bmatrix} 3\sqrt{2}/2 \\ 0 \\ +\frac{3\sqrt{2}}{2} \\ 0 \end{bmatrix}$$

$$P' = \left(T_3\, T_1\, T_2\right] P$$

$$P' = \begin{bmatrix} \sqrt{2}/2 & \sqrt{2}/2 & 0 & 0 \\ -\sqrt{2}/2 & \sqrt{2}/2 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -9 \\ 0 & 1 & 0 & 4 \\ 0 & 0 & 1 & 3 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{pmatrix} 3 \\ 0 \\ 0 \\ 0 \end{pmatrix} =$$

$$= \begin{bmatrix} \sqrt{2}/2 & 6 & \sqrt{2}/2 & 0 \\ -\sqrt{2}/2 & 0 & \sqrt{2}/2 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \quad \end{bmatrix} \begin{bmatrix} \quad \end{bmatrix} =$$

$$= \begin{bmatrix} \frac{\sqrt{2}}{2} & 6 & \frac{\sqrt{2}}{2} & -3\sqrt{2} \\ -\frac{\sqrt{2}}{2} & 0 & \sqrt{2}/2 & 6\sqrt{2} \\ 0 & -1 & 0 & -4 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{pmatrix} 3 \\ 0 \\ 6 \\ 0 \end{pmatrix} = \begin{bmatrix} \frac{3\sqrt{2}}{2} \\ -\frac{3\sqrt{2}}{2} \\ 0 \\ 0 \end{bmatrix}$$

Comprobamos que no se cumple la conmutatividad