Exercise 2

$$\overrightarrow{O'P'} \cdot (\overrightarrow{O'O} \times \overrightarrow{OP}) = 0$$

$$x' \cdot (t \times Rx) = 0$$

$$x'^T [t]_\times R x = 0$$

$$E = [t]_\times R$$

$$\therefore x'^T E x = 0$$

Exercise 3

(a)
$$\begin{cases} \frac{x_l}{f} = \frac{x_l'}{z_p} \\ \frac{x_r}{f} = \frac{x_r'}{z_p} \\ x_l' - x_r' = b \end{cases}$$

$$\therefore \begin{cases} \frac{z_p}{f} x_l - \frac{z_p}{f} x_r = b \\ x_l - x_r = d \end{cases}$$

$$\therefore \frac{z_p}{f} d = b$$

$$z_p = 6cm$$

(b)
$$\frac{z_p}{f} d = b$$

$$d = \frac{bf}{z_p} \leq 0.01mm$$

$$\therefore z_p \geq 60m$$

(c)
$$x'^T E x = 0$$

$$x = [I \ 0] \begin{bmatrix} 3 \\ 0 \\ 3 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 3 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 0 \\ 3 \end{bmatrix}$$

$$E = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & b \\ 0 & -b & 0 \end{bmatrix}$$

epipolar line constraint

$$Ex = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & b \\ 0 & -b & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 0 \\ 3 \end{bmatrix} = \begin{bmatrix} 0 \\ 18 \\ 0 \end{bmatrix}$$