P2/ From the problem, we know that

$$ {}^{B}_{A}T = \begin{bmatrix} R & t \\ 0^T & 1 \end{bmatrix} $$

a) Pure horizontal translation. $t = [tx, 0, 0]^T$, $R = I$

$$ E = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & -tx \\ 0 & tx & 0 \end{bmatrix} = [tx]R $$

1/ from the lecture, we know that $\begin{cases} E e_B = 0 \\ E^T e_A = 0 \end{cases}$

$\Rightarrow$, we get $e_A = e_B = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$

2) $\begin{bmatrix} a \\ b \\ c \end{bmatrix} = E^T \begin{bmatrix} X_A \\ Y_A \\ 1 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & tx \\ 0 & -tx & 0 \end{bmatrix} \begin{bmatrix} X_A \\ Y_A \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ tx \\ -tx Y_A \end{bmatrix}$

So, l_B: $tx \cdot y - tx Y_A = 0 \Rightarrow l_B: y = Y_A$.

3) assume $e_1 = e_A = [1, 0, 0]$

$$ e_2 = \frac{1}{\sqrt{e_{1x}^2 + e_{1y}^2}} [-e_{1y}, e_{1x}, 0]^T = [0, 1, 0]^T $$

$e_3 = e_1 \times e_3$

$= [0, 0, 1]^T$

$\therefore H_A = \begin{bmatrix} e_1^T \\ e_2^T \\ e_3^T \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$, $H_B = RH_A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

Thus, epipolar rectification's possible

b) Given $t = [tx, ty, 0]$, $R = I$.

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

1) According to $\begin{cases} E e_B = 0 \\ E^T e_A = 0 \end{cases}$

$$ \Rightarrow e_A = e_B = \left[\frac{tx}{\sqrt{tx^2 + ty^2}}, \frac{ty}{\sqrt{tx^2 + ty^2}}, 0 \right]^T $$