Q.2

Let K_1 and K_2 be two camera matrices. We know that the fundamental matrix corresponding to these camera matrices is of the following from:

$$F = S_b R \tag{1}$$

where S_b is the matrix

$$S_b = \begin{pmatrix} 0 & b_y & -b_z \\ -b_y & 0 & b_x \\ b_z & -b_x & 0 \end{pmatrix} \tag{2}$$

Assume that $K_1 = [I|0]$ and $K_2 = [\mathbf{R}|\mathbf{b}]$, where $\mathbf{R}$ is a 3×3 (non-singular) matrix. Prove that the last column of K_2, denoted by $\mathbf{b}$, is one of the epipoles.

Solution:

$$S_b = \begin{pmatrix} 0 & b_y & -b_z \\ -b_y & 0 & b_x \\ b_z & -b_x & 0 \end{pmatrix}$$

We know that the two epipoles of any stereo system can be expressed as:

$Fe' = 0$; $F = S_b R$ and $Fe = 0$; $F^T = R^T S_b^T$

Since S_b is skew-symmetric, we have $S_b^T = -S_b$.

Thus, we can simply plug in **b** for e and e' :

$F^T b = R^T S_b^T b$

$= - R^T S_b b$

$= - A\boldsymbol{0}$

Since $S_b b = 0$, **b** must clearly be the epipole. Hence proved