Problem 4 b) Given a 4×4 matrix H representing a projective transformation in 3D space, prove that the fundamental matrices corresponding to the two pairs of camera matrices $(M, M')$ and $(MH, MH')$ are the same.

Given a 3D point $P$ in the real world, we can write the value of $P$ in each camera space as:

$$p = M \cdot P, \quad p' = M' P$$

When the camera space is transformed to $(MH, MH')$ we can observe the transformation of the point $P$ as:

$$P_H = H^{-1} P, \quad P'_H = H^{-1} P'$$

Finally,

$$P_H = MH P_H$$
$$= MHH^{-1} P$$
$$= MP$$
$$= p$$

and

$$p'_H = MH P'_H$$
$$= MHH^{-1} P'$$
$$= MP'$$
$$= p'$$

Therefore, the fundamental matrices corresponding to the two pairs of camera matrices are the same.