KERRY GIP

Quiz 1

Question 1.

Given the two lines l_1 = [2, 3,-1] and l_2= [4,2,7] in homogeneous coordinates. Find their intersection point using the cross-product. What is the inhomogenous representation of the intersection point?

Question 2.

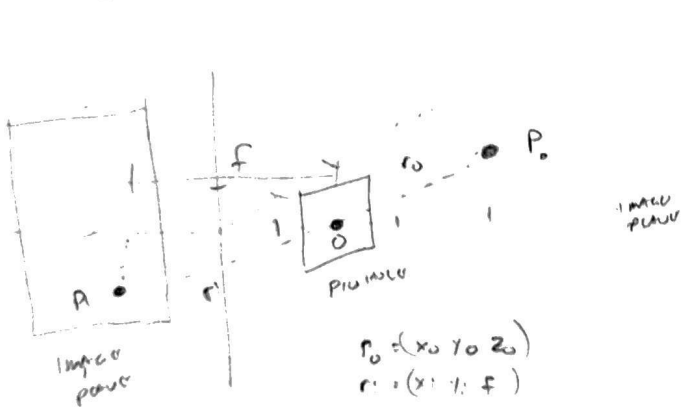
Given a 3D point p=[3,1,2] in inhomogeneous coordinates. What is the projection of this point on the image plane with perspective and orthographic projection. Let the focal length be denoted by *f*. You can ignore scaling.

1) $\begin{bmatrix} 2 \\ 3 \\ -1 \end{bmatrix} \times \begin{bmatrix} 4 \\ 2 \\ 7 \end{bmatrix} = \begin{bmatrix} b_2c_3 - b_3c_2 \\ -(b_1c_3 - b_3c_1) \\ b_1c_2 - b_2c_1 \end{bmatrix} = \begin{bmatrix} 2\cdot 1 + (+1\cdot 2) \\ -(14 + (+1)(4)) \\ (\text{illegible} + 12) \end{bmatrix} = \begin{bmatrix} 23 \\ -18 \\ -8 \end{bmatrix}$

3×1 3×1

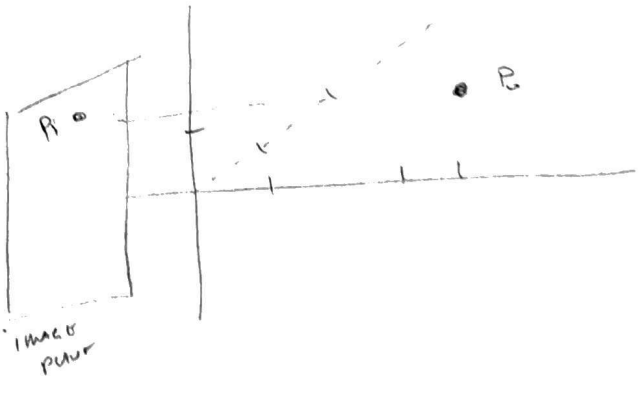
INHOMOGENEOUS REPRESENTATION: $\begin{bmatrix} 23/-8 \\ -18/-8 \\ -8/-8 \end{bmatrix} = \begin{bmatrix} -23/8 \\ 18/8 \\ 1 \end{bmatrix} = \begin{bmatrix} -23/8 \\ 18/8 \end{bmatrix}$

2) (3, 1, 2)



$r_0 = (x_0\ y_0\ z_0)$

$r' = (x'\ y'\ f)$



PERSPECTIVE

$\frac{r'}{f} = \frac{r_0}{z_0}$ $\quad z_0 = 2$

$\frac{x'}{f} = \left(\frac{x_0}{z_0}\right), \frac{y'}{f} = \left(\frac{y_0}{z_0}\right)$

$\left(\frac{2}{2}, \frac{1}{2}\right) = \left(\frac{3}{2}, \frac{1}{2}\right)$

ORTHOGRAPHIC PROJECTION: IGNORE & COMPUTE

$\begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$

2.) PERSPECTIVE PROOF

$$P_S \begin{bmatrix} f & 0 & 0 & 0 \\ 0 & f & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \begin{bmatrix} 3 \\ 1 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 3f \\ 1f \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{3f}{2} \\ 1f/2 \end{bmatrix} = f \cdot \begin{pmatrix} 3/2 \\ 1/2 \end{pmatrix}$$

BUT u/o f