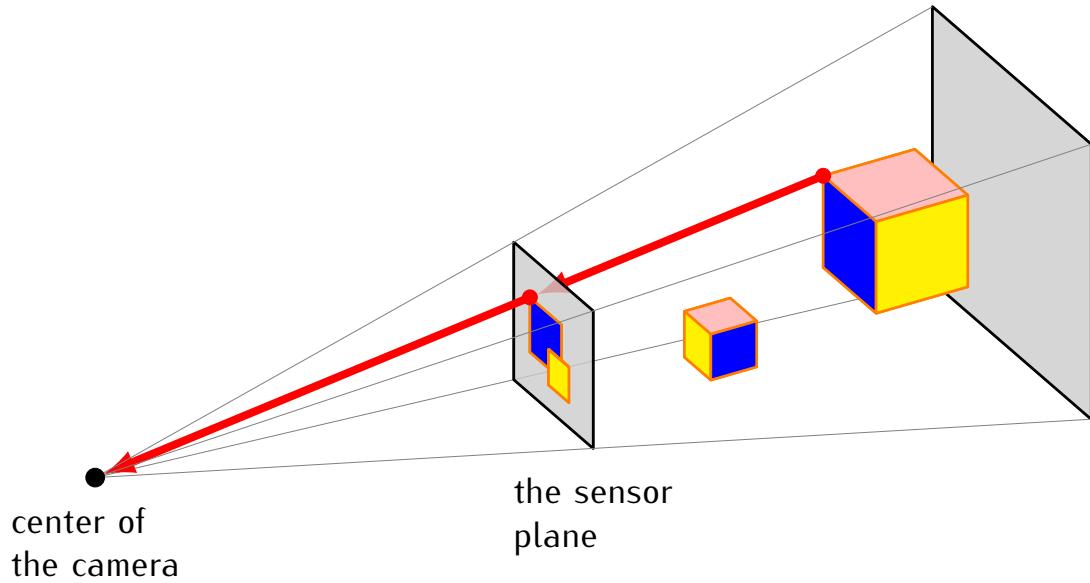
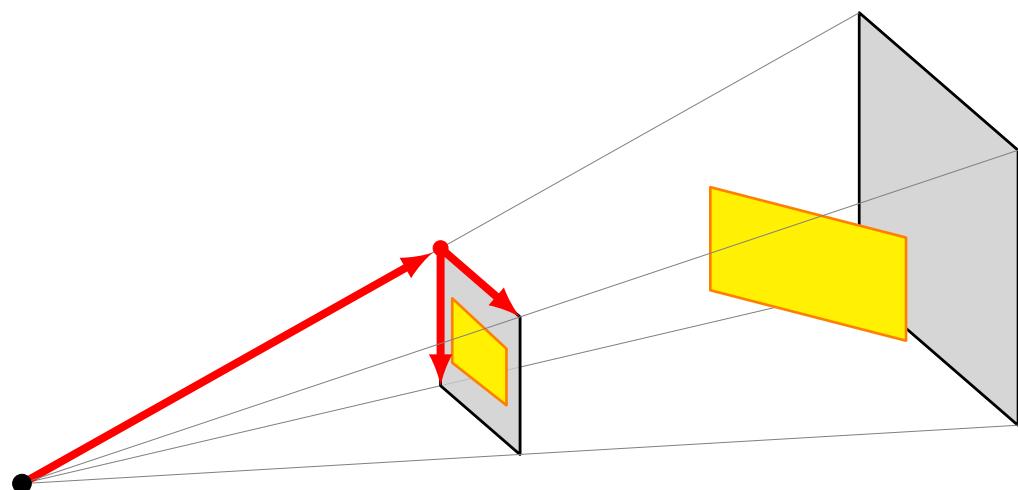
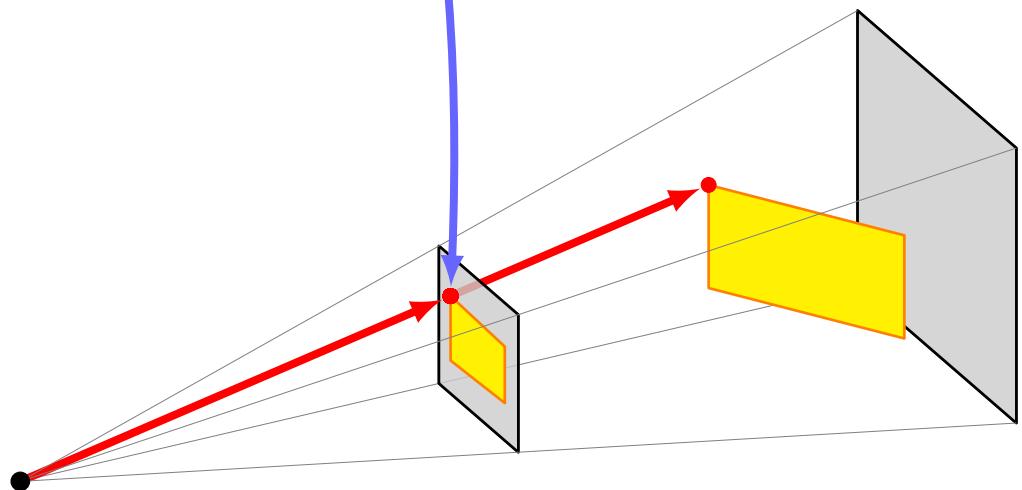


Image formation in a camera

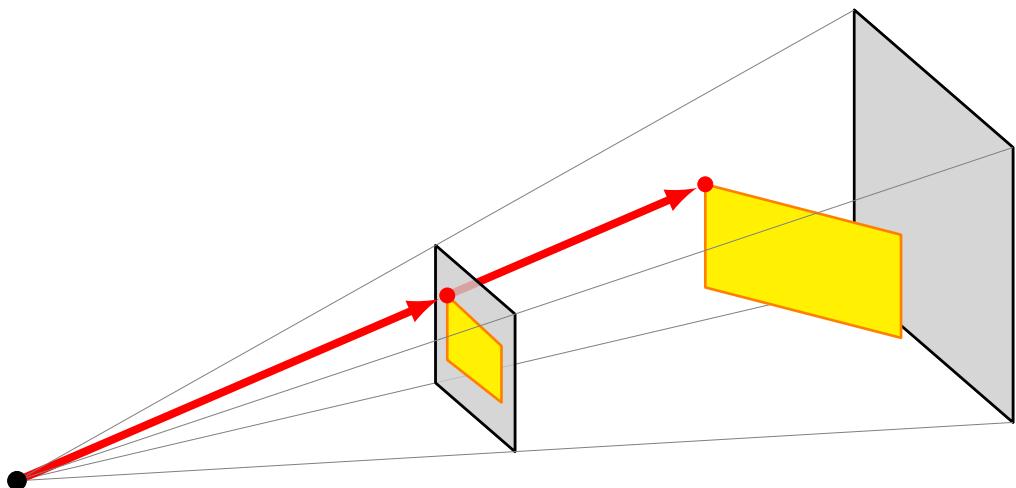
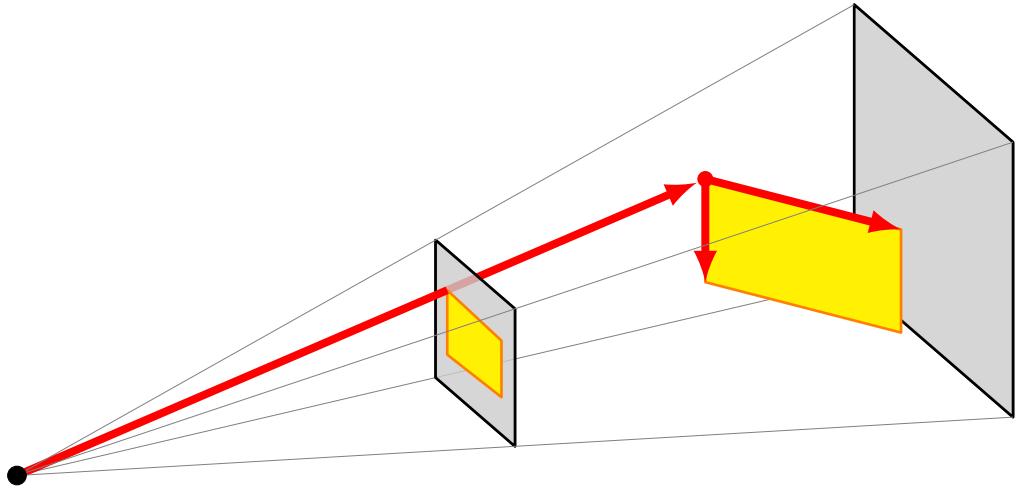


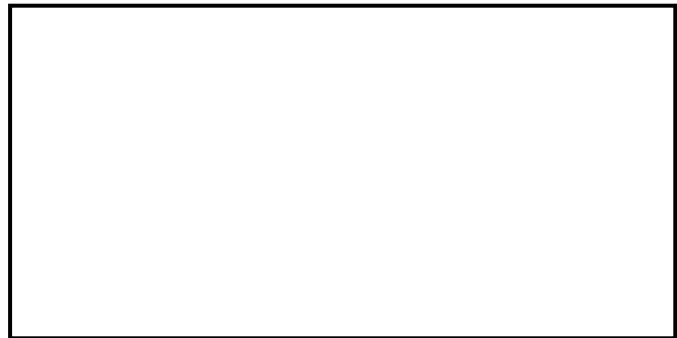
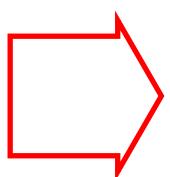
The camera coordinate system \mathcal{C}





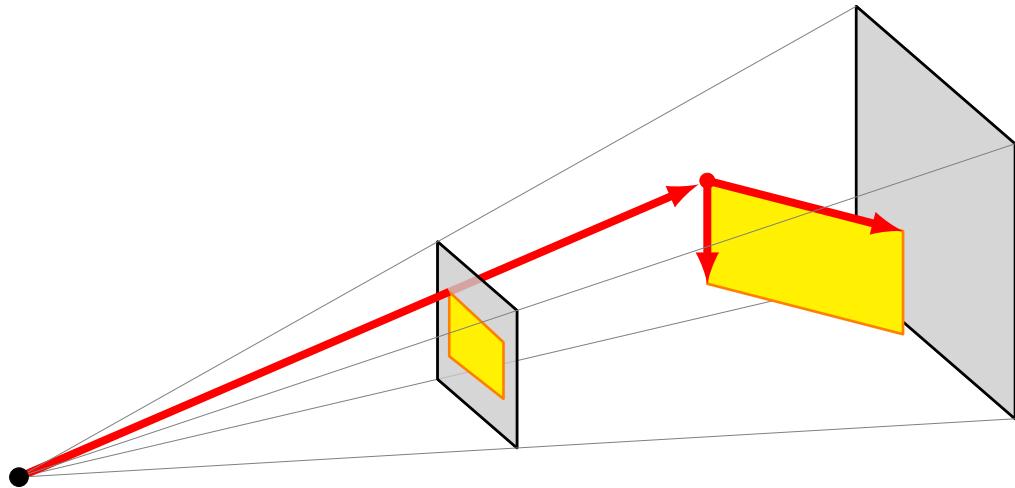
The mural coordinate system \mathcal{M}





From mural coordinates to camera coordinates

$$P_{C \leftarrow M} = [[\mathbf{m}_1]_C \quad [\mathbf{m}_2]_C \quad [\mathbf{m}_3]_C]$$



Problem: What are the numbers a , b , c ?

Definition

If

$$\mathbf{u} = \begin{bmatrix} a_1 \\ \vdots \\ a_n \end{bmatrix} \quad \mathbf{v} = \begin{bmatrix} b_1 \\ \vdots \\ b_n \end{bmatrix}$$

are vectors in \mathbb{R}^n then the *inner product* (or *dot product*) of \mathbf{u} and \mathbf{v} is the number

$$\mathbf{u} \cdot \mathbf{v} = a_1 b_1 + \dots + a_n b_n$$

Properties of the dot product:

- 1) $\mathbf{u} \cdot \mathbf{v} = \mathbf{v} \cdot \mathbf{u}$
- 2) $(\mathbf{u} + \mathbf{v}) \cdot \mathbf{w} = \mathbf{u} \cdot \mathbf{w} + \mathbf{v} \cdot \mathbf{w}$
- 3) $(c\mathbf{u}) \cdot \mathbf{v} = c(\mathbf{u} \cdot \mathbf{v})$
- 4) $\mathbf{u} \cdot \mathbf{u} \geq 0$ and $\mathbf{u} \cdot \mathbf{u} = 0$ if and only if $\mathbf{u} = \mathbf{0}$.