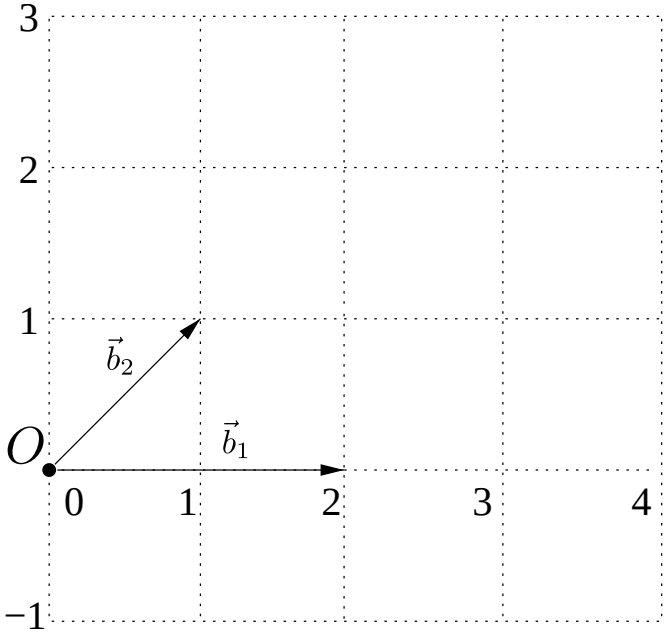
GVG Lab-05 EN

1. The following picture shows a coordinate system $\sigma = (O, \beta)$ and a basis $\beta = (\vec{b}_1, \vec{b}_2)$.



   (a) Find a coordinate system $\sigma' = (O', \beta')$, $\beta' = (\vec{b}'_1, \vec{b}'_2)$, whose basis vector $\vec{b}'_1$ has in basis β coordinates

$$\vec{b}'_{1\beta} = \begin{bmatrix} 1 \\ -1 \end{bmatrix}$$

   and its origin O' is in the coordinate system σ described by vector

$$\vec{O}'_{\beta} = \begin{bmatrix} 1/2 \\ 1 \end{bmatrix}$$

   and there exists point X described by vector $\vec{X}$ in σ and vector $\vec{X}'$ in σ' with coordinates

$$\vec{X}_{\beta} = \begin{bmatrix} 3/2 \\ 1 \end{bmatrix}, \quad \vec{X}'_{\beta'} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

   and draw it on the picture.

   (b) Write the coordinates of the point O in coordinate system σ'.

2. Find coordinates of the image point which is the projection of point $[1, 1, 1]^\top$ by the camera with the following camera projection matrix

$$\mathtt{P} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

3. Find the camera calibration matrix $\mathtt{K}$, rotation $\mathtt{R}$, and the projection center $\vec{C}_\delta$ of a camera with the camera projection matrix

$$\mathtt{P} = \begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

4. Denote the image coordinates by $[u, v]^\top$. Write down coordinates of all points in the three-dimensional space that projects on the line $v = 0$ by a camera with the following camera projection matrix

$$\mathtt{P} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 2 \end{bmatrix}$$