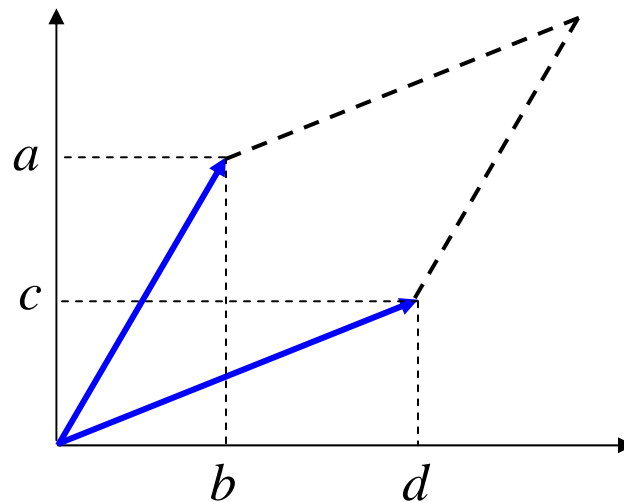


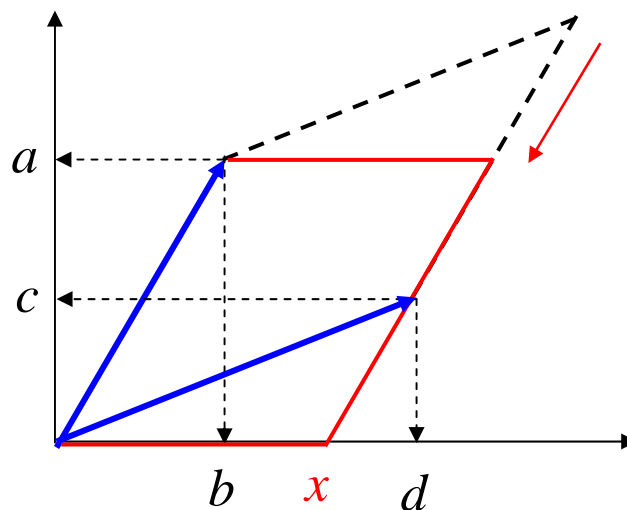
# DETERMINANTS AS VOLUMES

For  $n = 2$  let  $A = \begin{pmatrix} a & c \\ b & d \end{pmatrix}$ , so that  $\det(A) = ad - bc$

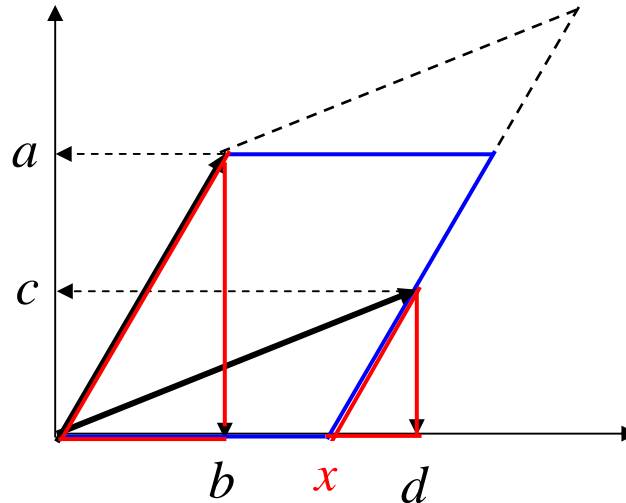
Now look at the image of the **positive unit square**:



Now observe that the area is **not changed** by sliding the right side down to the axis:



But by similar triangles,



it follows that:

$$\frac{d-x}{c} = \frac{b}{a} \Rightarrow x = d - \frac{bc}{a}$$

Hence the **area** of the image of this unit square is given by “base  $\times$  height” as:

$$\text{Area} = a \cdot \left( d - \frac{bc}{a} \right) = ad - bc$$

