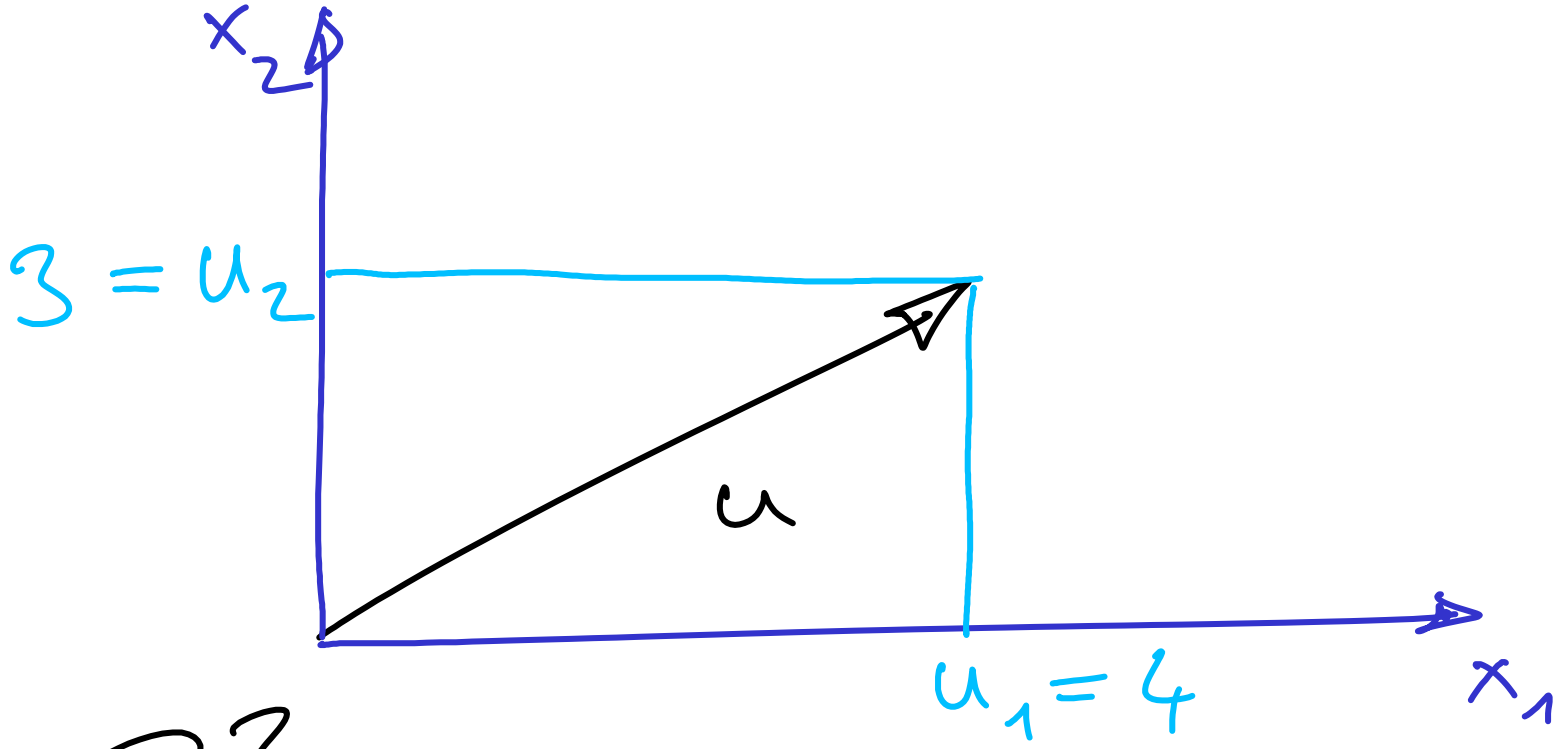
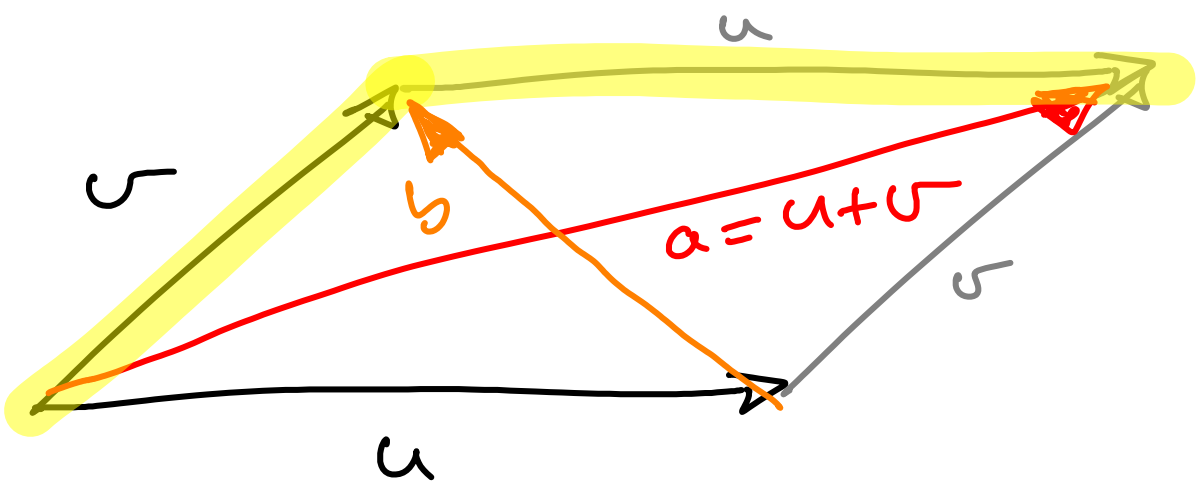


$$u \in \mathbb{R}^2$$

$$u = \begin{pmatrix} u_1 \\ u_2 \end{pmatrix}$$

$$\|u\| = \sqrt{u_1^2 + u_2^2} = \sqrt{16 + 9} = 5$$

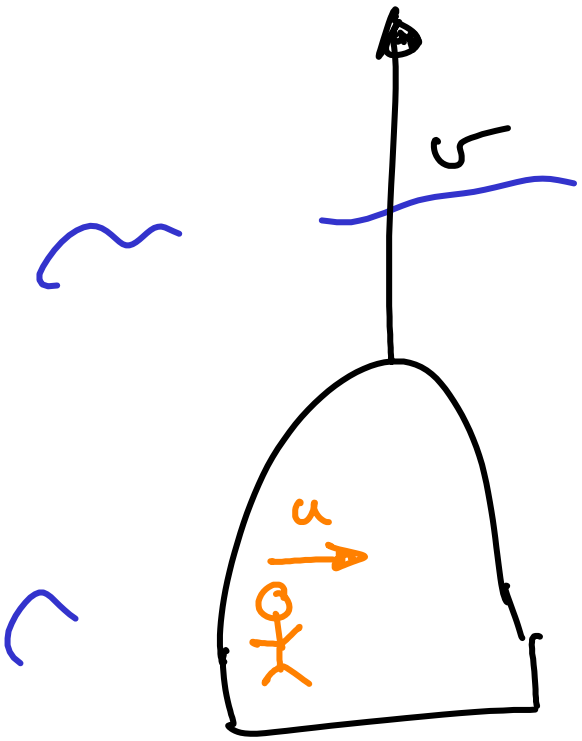
$$b = -a + v$$
$$= v - u$$



$$u = \begin{pmatrix} 3 \\ 0 \end{pmatrix}, \quad v = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

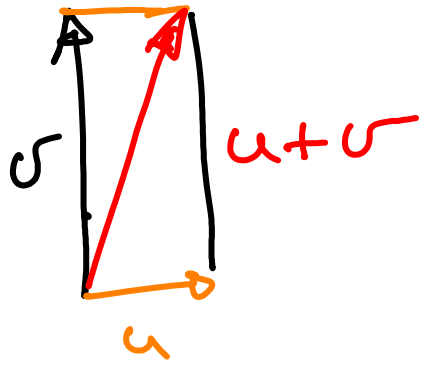
$$u + v = \begin{pmatrix} 3+1 \\ 0+2 \end{pmatrix} = \begin{pmatrix} 4 \\ 2 \end{pmatrix}$$

$$a = u + v$$
$$= v + u$$



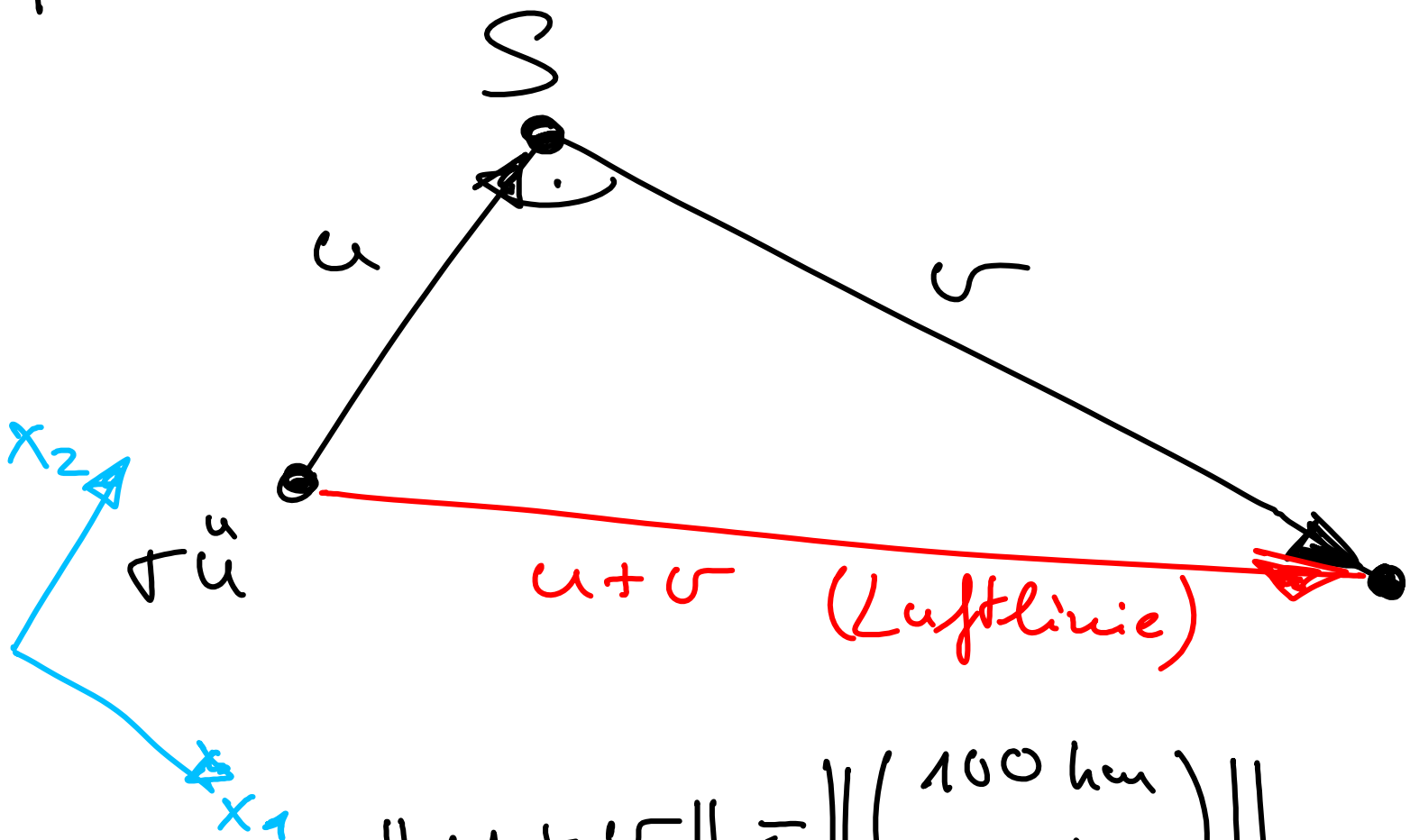
v : Geschw. Schiff zu Wasser

u : Geschw. Person zu Schiff



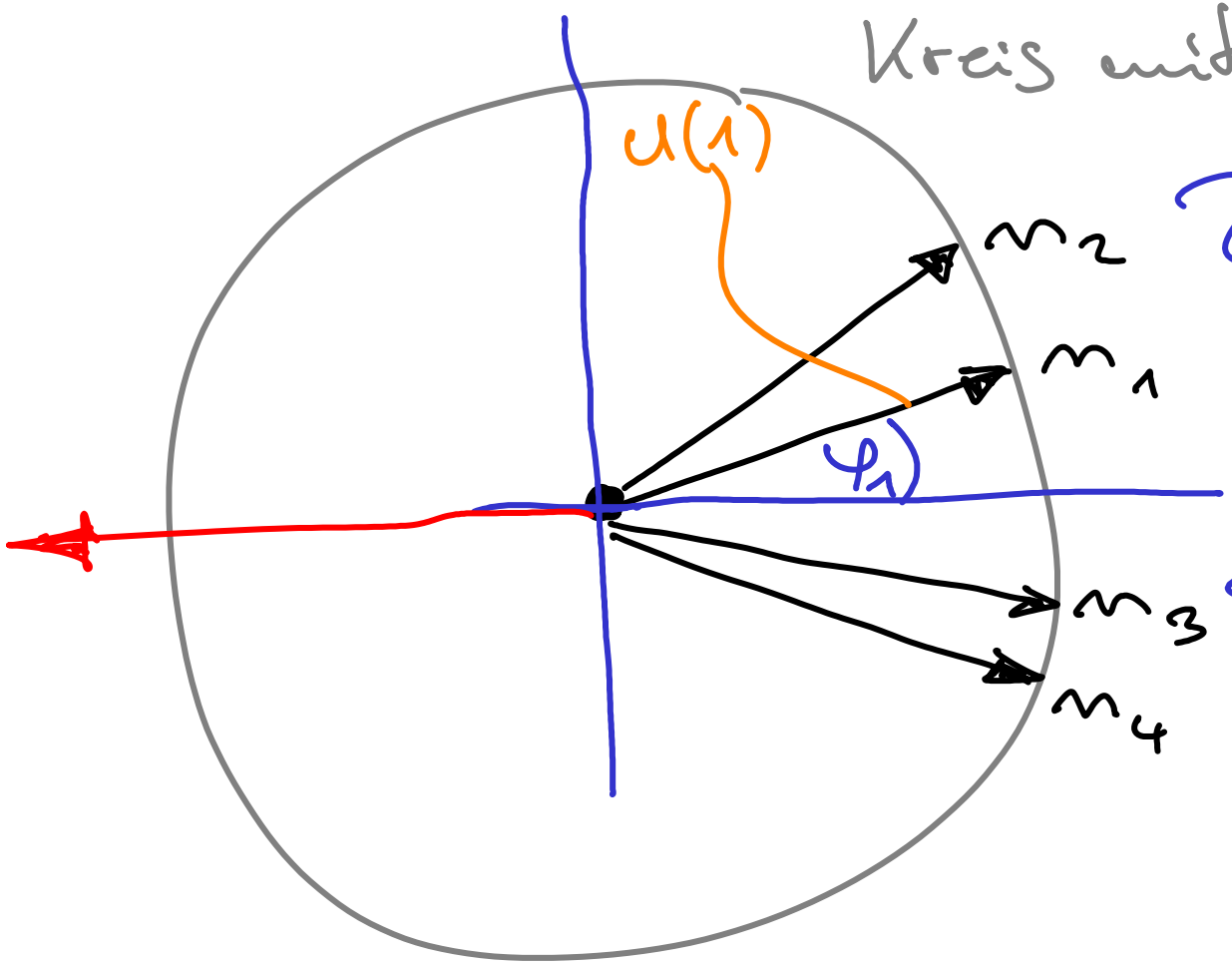
$u+v$: Geschw. Person zu Wasser

$$u = \begin{pmatrix} 0 \\ 50\,\text{km} \end{pmatrix}, \quad v = \begin{pmatrix} 100\,\text{km} \\ 0 \end{pmatrix}$$



$$\|u+v\| = \left\| \begin{pmatrix} 100\,\text{km} \\ 50\,\text{km} \end{pmatrix} \right\|$$

$$= \sqrt{10000 + 2500}\,\text{km} \approx 110\,\text{km}$$

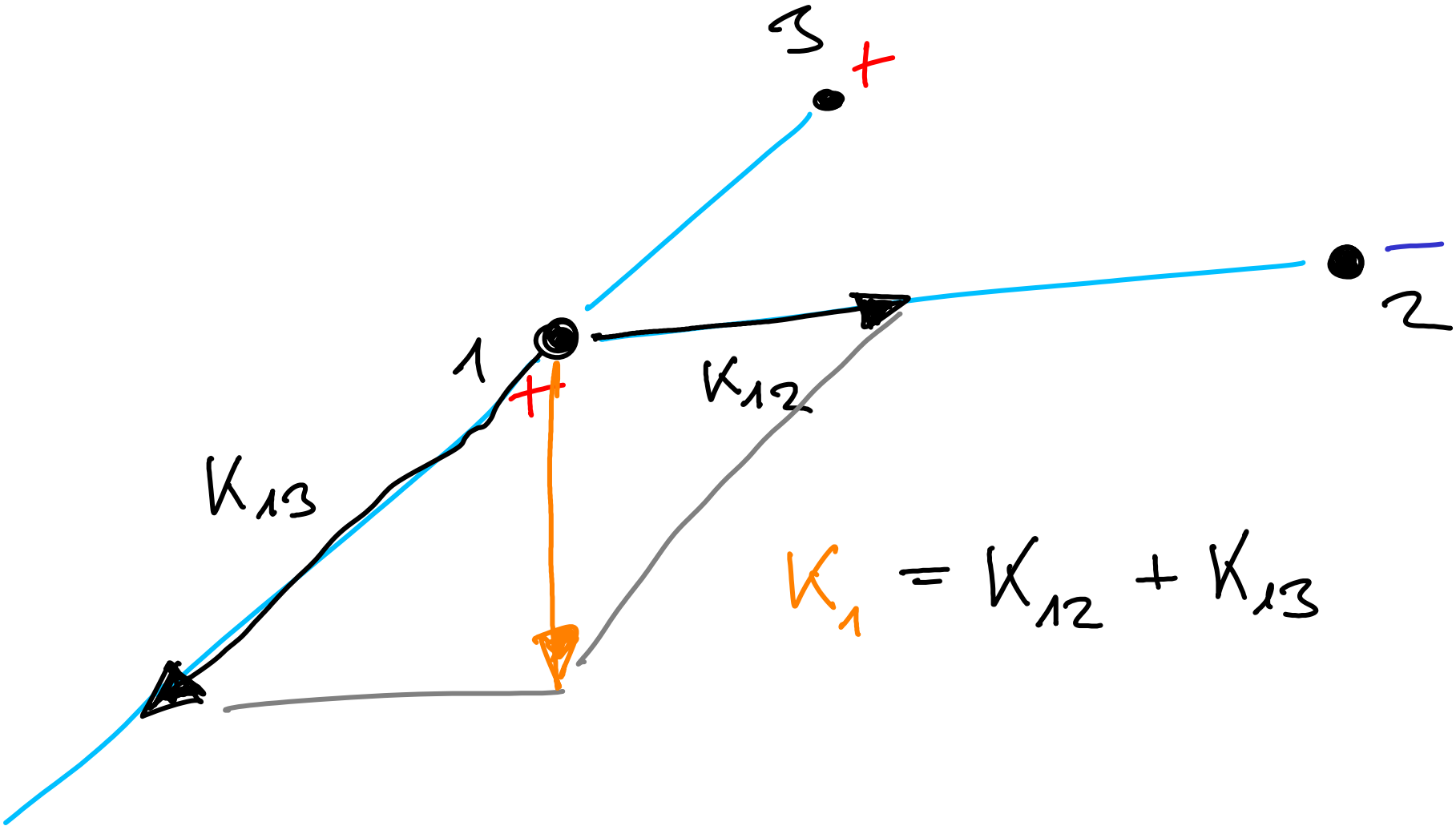


φ_1 und $\varphi_2 \approx 0°$

φ_3 und $\varphi_4 \approx 360°$

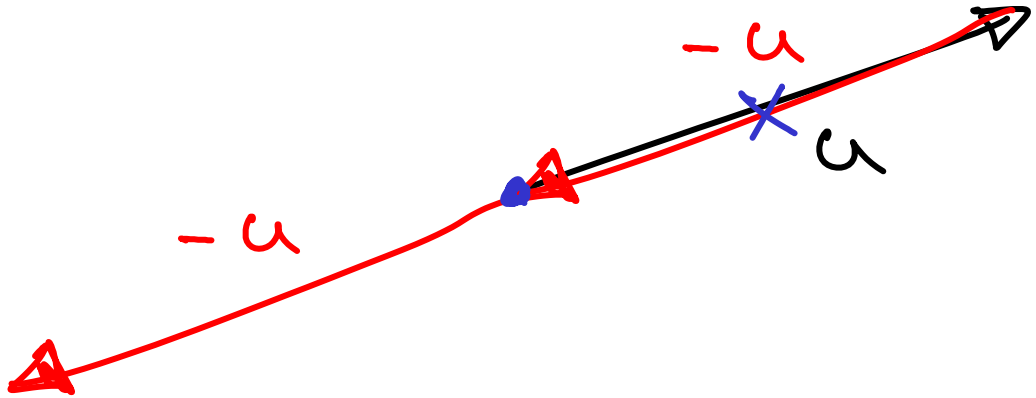
$$\frac{\varphi_1 + \varphi_2 + \varphi_3 + \varphi_4}{4} \approx 180°$$

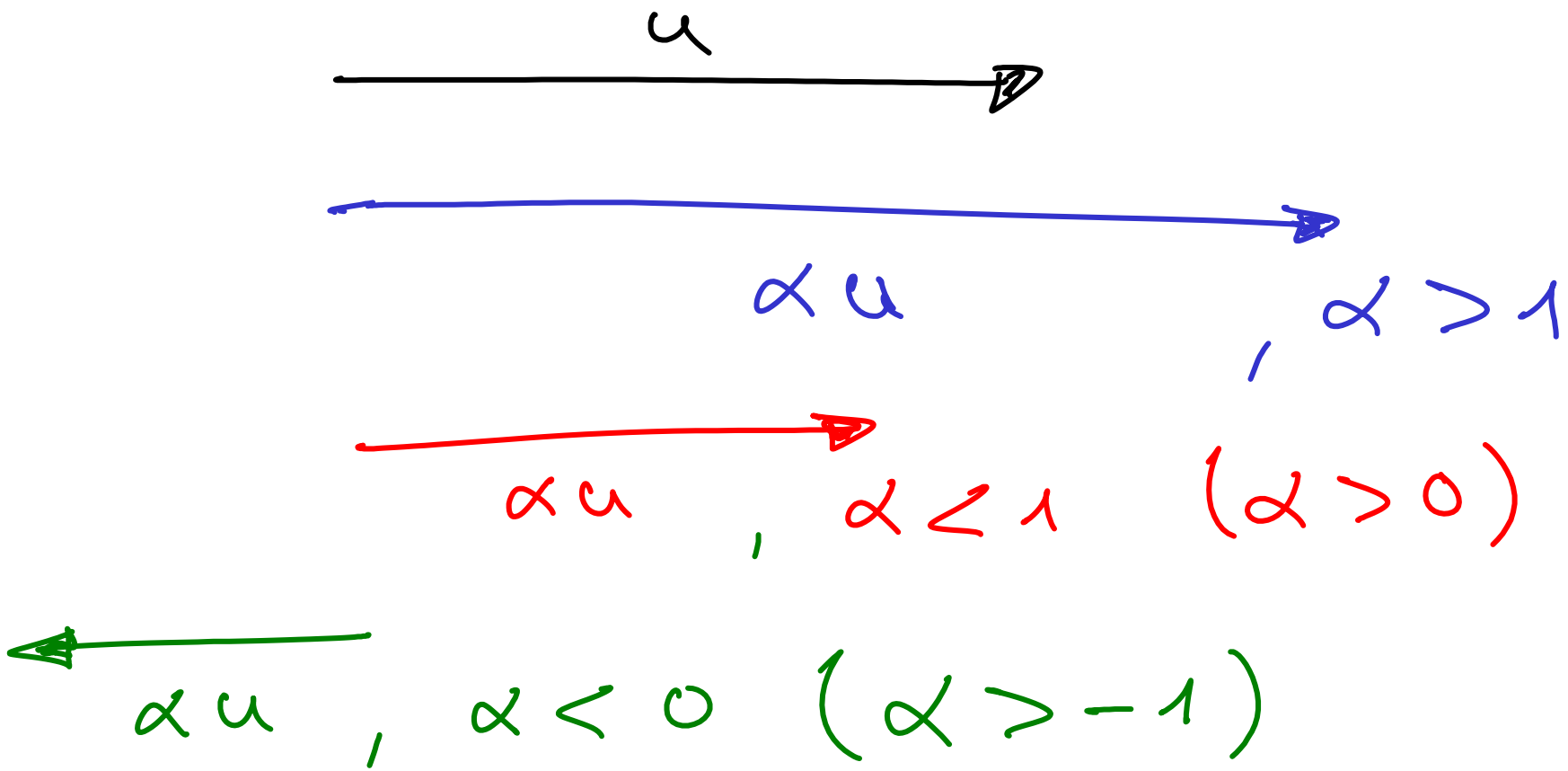
nicht gut

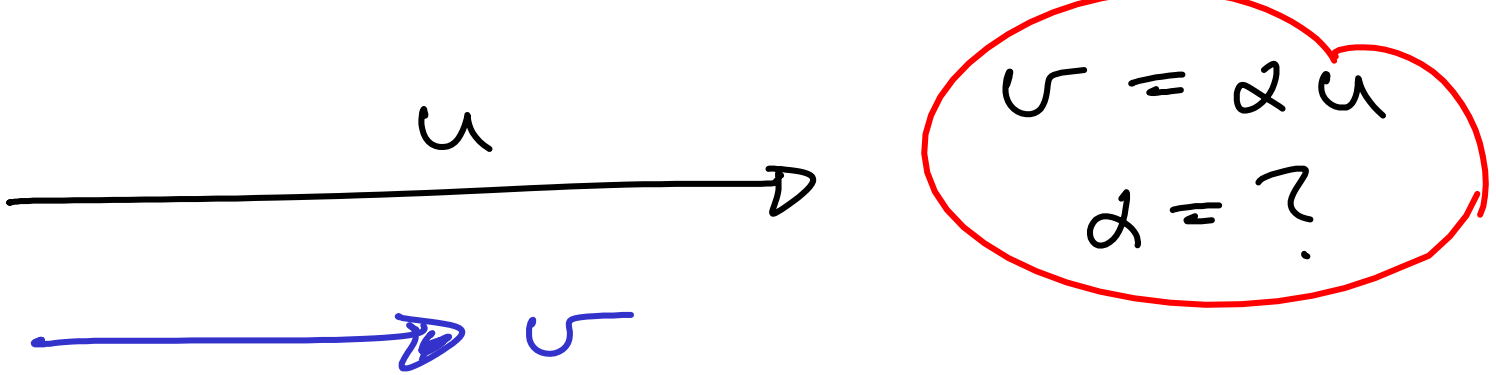

3
+
1
+
2
−
K_{12}
K_{13}
$K_1 = K_{12} + K_{13}$

Nullvektor läßt sich schlecht zeichnen

$$0 = \begin{pmatrix} 0 \\ 0 \\ \vdots \\ 0 \end{pmatrix}$$




u
αu , α > 1
αu , α < 1 (α > 0)
αu , α < 0 (α > −1)



$$u \parallel v \iff \frac{u}{\|u\|} = \frac{v}{\|v\|}$$

$$\implies v = \frac{\|v\|}{\|u\|} u$$

α

$O\,u = O$ heißt in Komponenten

$$O \begin{pmatrix} u_1 \\ \vdots \\ u_n \end{pmatrix} = \begin{pmatrix} 0 \\ \vdots \\ 0 \end{pmatrix}$$

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1m} \\ a_{21} & & & \vdots \\ \vdots & & & \vdots \\ a_{n1} & \cdots & \cdots & a_{nm} \end{pmatrix}$$

$n \times m$

rechteckig für $n \neq m$

$$A = (a_{ij}), \quad \begin{matrix} i = 1, \dots, n \\ j = 1, \dots, m \end{matrix}$$

$$\begin{pmatrix} 1 & 0 & 1 \\ 2 & 1 & 3 \end{pmatrix} + \begin{pmatrix} 0 & 0 & 5 \\ 1 & 2 & 7 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 & 6 \\ 3 & 3 & 10 \end{pmatrix}$$

alle 2×3

~~$\begin{pmatrix} 1 & 0 & 1 \\ 2 & 1 & 3 \end{pmatrix} + \begin{pmatrix} 1 & 0 \\ 1 & 2 \end{pmatrix}$~~

geht nicht

$$\begin{pmatrix} 1 & 2 & 4 \\ 3 & 1 & 5 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 2 & 2 & 0 \\ 1 & 1 & 3 & 1 \end{pmatrix}$$

2×3 $\qquad$ 3×4

$$A = \begin{pmatrix} 1 & 2 & 4 \\ 3 & 1 & 5 \end{pmatrix} \qquad \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 2 & 2 & 0 \\ 1 & 1 & 3 & 1 \end{pmatrix} = B$$

$$\begin{pmatrix} 5 & 8 & 17 & 4 \\ 8 & 7 & 20 & 5 \end{pmatrix} = A \cdot B$$

$$1 \cdot 1 + 2 \cdot 2 + 4 \cdot 3 = 17$$