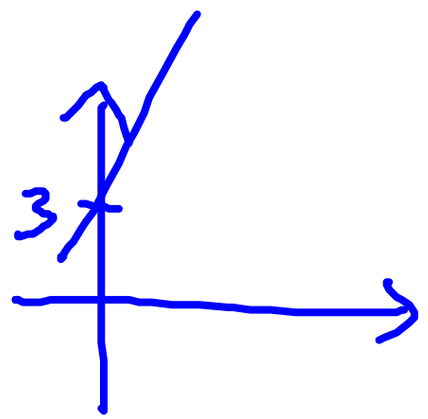
# Aufgabenblatt 1 / Wiederholungsklausur

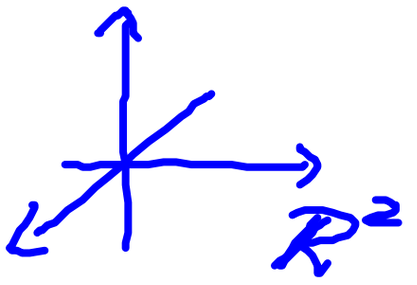
## Thema: Abbildungen

- $f: \mathbb{R} \to \mathbb{R}$
  $x \mapsto 2x+3 \quad y=2x+3 \quad f(x)=2x+3$




- $f: \mathbb{R}^2 \to \mathbb{R}$
  $\begin{pmatrix} x \\ y \end{pmatrix} \mapsto 2x+3y \quad f\left(\begin{pmatrix} x \\ y \end{pmatrix}\right)=2x+3y$

"Wie male ich das?"




- $f: \mathbb{R}^3 \to \mathbb{R}$
  $\begin{pmatrix} x \\ y \\ z \end{pmatrix} \mapsto 2x+y+3z$

- $f: \mathbb{R} \to \mathbb{R}^2$
  $x \mapsto \begin{pmatrix} 2x \\ x \end{pmatrix}$

- $f: \mathbb{R}^2 \to \mathbb{R} \quad f\left(\begin{pmatrix} x \\ y \end{pmatrix}\right)=3x-2y$
  $\begin{pmatrix} x \\ y \end{pmatrix} \mapsto 3x-2y$

~~$f\left(\begin{pmatrix} x \\ y \end{pmatrix}\right) = \begin{pmatrix} 3x-2y \\ 0 \end{pmatrix} \in \mathbb{R}^2$~~

$$f: \mathbb{R}^2 \to \mathbb{R}, \quad \begin{pmatrix} x \\ y \end{pmatrix} \mapsto 3x - 2y$$

Gruppenhomomorphismus? (i) ✓
lineare Abbildung? (i)+(ii) ✓

(i) $$f\left(\begin{pmatrix} x_1 \\ y_1 \end{pmatrix} + \begin{pmatrix} x_2 \\ y_2 \end{pmatrix}\right) = f\left(\begin{pmatrix} x_1 + x_2 \\ y_1 + y_2 \end{pmatrix}\right) = 3 \cdot (x_1 + x_2) - 2 \cdot (y_1 + y_2)$$
$$= (3 \cdot x_1 - 2y_1) + (3x_2 - 2y_2)$$
$$= f\left(\begin{pmatrix} x_1 \\ y_1 \end{pmatrix}\right) + f\left(\begin{pmatrix} x_2 \\ y_2 \end{pmatrix}\right) \quad \square$$

(ii) $$f\left(\lambda \cdot \begin{pmatrix} x \\ y \end{pmatrix}\right) = f\left(\begin{pmatrix} \lambda \cdot x \\ \lambda \cdot y \end{pmatrix}\right) = 3 \cdot (\lambda \cdot x) - 2 \cdot (\lambda \cdot y)$$
$$= \lambda \cdot 3x - \lambda \cdot 2y$$
$$= \lambda \cdot (3x - 2y)$$
$$= \lambda \cdot f\left(\begin{pmatrix} x \\ y \end{pmatrix}\right) \quad \square$$

$$f: \mathbb{R}^4 \longrightarrow \mathbb{R}^3$$

$$\begin{pmatrix} x \\ y \\ z \\ w \end{pmatrix} \longmapsto \begin{pmatrix} 2x-2y \\ y-z \\ 2w-x \end{pmatrix} = \begin{pmatrix} 2 & -2 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ -1 & 0 & 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ w \end{pmatrix}$$

$$\begin{pmatrix} 2 & -2 & 0 & 0 \\ 0 & 1 & -1 & 0 \\ -1 & 0 & 0 & 2 \end{pmatrix} \begin{pmatrix} x \\ y \\ z \\ w \end{pmatrix} = \begin{pmatrix} 3 \\ 5 \\ 7 \end{pmatrix}$$