$\underline{\mathbb{R}^4}$: $\vec{a}$; $\vec{c}$

$$\vec{a}-\vec{c} = (-2; 6; -5; 11)^T$$

$$|\vec{c}-\vec{c}| = \sqrt{4+36+25+121}$$

$$\vec{a} * \vec{c}: 8+0-6-30 = -28$$

$\underline{\mathbb{R}^3}$: $\vec{b}$; $\vec{d}$

$$\vec{b}-\vec{d} = (-7; -7; 8)^T$$

$$|\vec{b}-\vec{d}| = \sqrt{49+49+64}$$

$$\vec{b} * \vec{d} = -12+0-16 = -28$$

$$\vec{b} \times \vec{d} = \begin{pmatrix} 0-28 \\ 16-12 \\ -21-0 \end{pmatrix} = \begin{pmatrix} -28 \\ 4 \\ -21 \end{pmatrix}$$

2)

a) $\vec{a} = \begin{pmatrix} 3 \\ 2 \\ -1 \\ 4 \end{pmatrix}$; $\vec{b} = \begin{pmatrix} -5 \\ 3 \\ x \\ 1 \end{pmatrix}$ $\Rightarrow \measuredangle : f(\vec{a};\vec{b}) = 0$

$\vec{a} * \vec{b} = -15 + 6 - x + 4 = 0$ $x = -5$

b) $\vec{a} * \vec{b} = -8 + 6 + 0 + 2y - 6 = 0$

$y = 4$

Wann sind Vektoren (quasi) gleich ?

$y = \frac{2}{3}x + 5$; $y = \frac{4}{6}x + 7$

$\downarrow$ $\qquad\qquad\qquad\qquad$ $\downarrow$

$3 \rightarrow \; 1 \; 2 \uparrow$ $\qquad\qquad$ $6 \rightarrow \; 1 \; 4 \uparrow$

$$\begin{pmatrix} 1 \\ 2 \\ -3 \end{pmatrix} \xrightarrow{\cdot(-2)} \begin{pmatrix} -2 \\ -4 \\ 6 \end{pmatrix}$$

auseinander erzeugbar

$\Rightarrow$ (quasi) gleich

↳ linear abhängig

$$\begin{pmatrix} 1 \\ -2 \\ 3 \end{pmatrix} ; \begin{pmatrix} 3 \\ 2 \\ -1 \end{pmatrix} ; \begin{pmatrix} -4 \\ -6 \\ 8 \end{pmatrix}$$

$$\vec{a} \qquad \vec{b} \qquad \vec{c}$$

$$\alpha \cdot \vec{a} + \beta \cdot \vec{b} = \gamma \cdot \vec{c} \qquad | - \gamma \cdot \vec{c}$$

$$\alpha \cdot \vec{a} + \beta \cdot \vec{b} + \gamma \cdot \vec{c} = \vec{0}$$

$\alpha = \beta = \gamma = 0$ (Triviallösung)

=> linear unabhängig

=> Basis

=> Dimension 3

Linearkombination $\quad \alpha \cdot \vec{a} + \beta \cdot \vec{b} + \gamma \cdot \vec{c} = \vec{0}$

$$\left| \begin{array}{rrrcl} \alpha & +3\beta & -4\gamma & = & 0 \\ -2\alpha & +2\beta & -6\gamma & = & 0 \\ 3\alpha & -\beta & +8\gamma & = & 0 \end{array} \right| \quad \text{Pivot } |\cdot 2 \quad |\cdot(-3)$$

$$\left| \begin{array}{rrrcl} \alpha & +3\beta & -4\gamma & = & 0 \\ 0 & 8\beta & -14\gamma & = & 0 \\ 0 & -10\beta & +20\gamma & = & 0 \end{array} \right| \quad |\cdot \tfrac{1}{10}$$

$$\left| \begin{array}{rrrcl} \alpha & +3\beta & -4\gamma & = & 0 \\ 0 & -\beta & +2\gamma & = & 0 \\ 0 & 8\beta & -14\gamma & = & 0 \end{array} \right| \quad \text{Pivot } |\cdot 8$$

$$\left| \begin{array}{rrrcl} \alpha & +3\beta & -4\gamma & = & 0 \\ 0 & -\beta & +2\gamma & = & 0 \\ 0 & 0 & 2\gamma & = & 0 \end{array} \right| \quad \left.\begin{array}{l} \gamma = 0 \\ \beta = 0 \\ \alpha = 0 \end{array}\right\} \text{linear unabhängig}$$