

Computergrafik

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1.1

$$|v| = \left| \begin{pmatrix} 1 \\ 4 \\ 3 \end{pmatrix} \right| = \sqrt{1^2 + 4^2 + 3^2} = \sqrt{26} = 5,1$$

$$v \text{ normalisiert : } \frac{1}{\sqrt{26}} = 0,2 \quad \frac{4}{\sqrt{26}} = 0,78 \quad \frac{3}{\sqrt{26}} = 0,58$$

$$|v \text{ normalisiert}| : \sqrt{0,2^2 + 0,78^2 + 0,58^2} = 1$$

$$|v| = \left| \begin{pmatrix} 0 \\ 0 \\ 12 \end{pmatrix} \right| = \sqrt{0^2 + 0^2 + 12^2} = \sqrt{144} = 12$$

$$v \text{ normalisiert : } \frac{0}{\sqrt{12}} = 0 \quad \frac{0}{\sqrt{12}} = 0 \quad \frac{12}{\sqrt{12}} = 1$$

$$|v \text{ normalisiert}| : \sqrt{0^2 + 0^2 + 1^2} = 1$$

$$|v| = \left| \begin{pmatrix} -2 \\ 0 \\ 1 \end{pmatrix} \right| = \sqrt{(-2)^2 + 0^2 + 1^2} = \sqrt{5} = 2,24$$

$$v \text{ normalisiert : } \frac{-2}{\sqrt{5}} = -0,89 \quad \frac{0}{\sqrt{5}} = 0 \quad \frac{1}{\sqrt{5}} = 0,45$$

$$|v \text{ normalisiert}| : \sqrt{(-0,89)^2 + 0^2 + 0,45^2} = 1$$

1.2

$$\begin{pmatrix} 1 \\ 4 \\ 7 \end{pmatrix} \times \begin{pmatrix} -2 \\ 0 \\ 3 \end{pmatrix} = 19$$

$$\begin{pmatrix} -5 \\ 1 \\ 3 \end{pmatrix} \times \begin{pmatrix} 4 \\ -2 \\ 1 \end{pmatrix} = -19$$

$$\begin{pmatrix} -5 \\ 1 \\ 3 \end{pmatrix} \times \begin{pmatrix} 4 \\ -2 \\ 1 \end{pmatrix} = 0$$

1.3

$$\begin{pmatrix} 5 \\ 3 \\ 0 \end{pmatrix} \times \begin{pmatrix} -2 \\ 4 \\ 0 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 26 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} \times \begin{pmatrix} 0 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 0 \\ -1 \\ 1 \end{pmatrix}$$

1.4

$$\vec{c} = \vec{a} \times \vec{b} = \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix} \times \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix} = \begin{pmatrix} a_2 b_3 - a_3 b_2 \\ a_3 b_1 - a_1 b_3 \\ a_1 b_2 - a_2 b_1 \end{pmatrix}$$

$$\vec{c} \cdot \vec{a} = \begin{pmatrix} a_2 b_3 - a_3 b_2 \\ a_3 b_1 - a_1 b_3 \\ a_1 b_2 - a_2 b_1 \end{pmatrix} \cdot \begin{pmatrix} a_1 \\ a_2 \\ a_3 \end{pmatrix}$$

$$= (a_2 b_3 - a_3 b_1)(a_1) + (a_3 b_1 - a_1 b_3)(a_2) + (a_1 b_2 - a_2 b_1)(a_3)$$

$$= a_1 a_2 b_3 - a_1 a_3 b_2 + a_2 a_3 b_1 - a_1 a_2 b_3 + a_1 a_3 b_2 - a_2 a_3 b_1 = 0$$

$$\vec{c} \cdot \vec{b} = \begin{pmatrix} a_2 b_3 - a_3 b_2 \\ a_3 b_1 - a_1 b_3 \\ a_1 b_2 - a_2 b_1 \end{pmatrix} \cdot \begin{pmatrix} b_1 \\ b_2 \\ b_3 \end{pmatrix}$$

$$= (a_2 b_3 - a_3 b_1)(b_1) + (a_3 b_1 - a_1 b_3)(b_2) + (a_1 b_2 - a_2 b_1)(b_3)$$

$$= a_2 b_1 b_3 - a_3 b_1 b_2 + a_3 b_1 b_2 - a_1 b_2 b_3 + a_1 b_3 b_2 - a_2 b_1 b_3 = 0$$