

### III Addition und Subtraktion von Vektoren

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#### 2 Vektoren am Quader

$$\vec{AG} = \vec{b} - \vec{a} - \vec{c}$$

$$\vec{CE} = \vec{c} + \vec{b} + \vec{a}$$

$$\vec{FH} = -\vec{a} + \vec{c}$$

$$\vec{BF} = \vec{b}$$

$$\vec{DG} = \vec{b} - \vec{c}$$

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#### 3 Vektoraddition

$$\text{a) } \vec{PQ} + \vec{QR} = \vec{PR}$$

$$\text{b) } \vec{AB} + \vec{BA} = \vec{AA} = \vec{0}$$

$$\text{c) } \vec{PQ} - \vec{RQ} = \vec{PR}$$

$$\text{d) } \vec{QP} + \vec{RQ} = \vec{RP}$$

$$\text{e) } \vec{PQ} + \vec{QR} + \vec{RS} = \vec{PS}$$

$$\text{f) } \vec{PQ} - \vec{QR} + \vec{QP} = \vec{RQ}$$

$$\text{g) } \vec{AB} + \vec{A} = \vec{B}$$

$$\text{h) } \vec{PQ} - \vec{RS} - \vec{PR} = \vec{0}$$

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#### 5 Addition

$$\text{a) } \begin{pmatrix} 4 \\ -1 \\ 2 \end{pmatrix} + \begin{pmatrix} 3 \\ 2 \\ -4 \end{pmatrix} = \begin{pmatrix} 7 \\ 1 \\ -2 \end{pmatrix} \quad \text{b) } \begin{pmatrix} 2 \\ 1 \\ -3 \end{pmatrix} - \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \\ -5 \end{pmatrix} = \begin{pmatrix} 0 \\ 1 \\ -9 \end{pmatrix}$$

$$\text{c) } \begin{pmatrix} 3 \\ -4 \\ 5 \end{pmatrix} - \left[ \begin{pmatrix} -5 \\ 6 \\ 2 \end{pmatrix} - \begin{pmatrix} -2 \\ 3 \\ -4 \end{pmatrix} \right] = \begin{pmatrix} 10 \\ -7 \\ -1 \end{pmatrix}$$

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## 6 Verschiebung

$$\text{a) } \vec{B} = \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} = \begin{pmatrix} 4 \\ -2 \\ 6 \end{pmatrix}$$

$$\text{b) } \vec{B} = \begin{pmatrix} 17 \\ 11 \\ 31 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} = \begin{pmatrix} 19 \\ 10 \\ 34 \end{pmatrix}$$

$$\text{c) } \vec{B} = \begin{pmatrix} -17 \\ 11 \\ 31 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} = \begin{pmatrix} -15 \\ 10 \\ 34 \end{pmatrix}$$

$$\text{d) } \vec{B} = \begin{pmatrix} 33 \\ -71 \\ -181 \end{pmatrix} + \begin{pmatrix} 2 \\ -1 \\ 3 \end{pmatrix} = \begin{pmatrix} 35 \\ -72 \\ -178 \end{pmatrix}$$

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## 7 Addition

Gegeben:  $A(2 | -1 | 5)$ ,  $B(3 | 0 | 3)$ ,  $C(-2 | 7 | 1)$  und  $D(4 | 4 | 4)$

$$\text{a) } \vec{AB} + \vec{CD} = \begin{pmatrix} 1 \\ 1 \\ -2 \end{pmatrix} + \begin{pmatrix} 6 \\ -3 \\ 3 \end{pmatrix} = \begin{pmatrix} 7 \\ -2 \\ 1 \end{pmatrix}$$

$$\text{b) } \vec{AD} - \vec{BC} = \begin{pmatrix} 2 \\ 5 \\ -1 \end{pmatrix} - \begin{pmatrix} -5 \\ 7 \\ -2 \end{pmatrix} = \begin{pmatrix} 7 \\ -2 \\ 1 \end{pmatrix}$$

$$\text{c) } \vec{AB} - \vec{BC} - \vec{CA} = \begin{pmatrix} 1 \\ 1 \\ -2 \end{pmatrix} - \begin{pmatrix} -5 \\ 7 \\ -2 \end{pmatrix} - \begin{pmatrix} -4 \\ 8 \\ -4 \end{pmatrix} = \begin{pmatrix} 10 \\ -14 \\ 4 \end{pmatrix}$$

$$\text{d) } \vec{BD} + \vec{AC} - \vec{DB} = \begin{pmatrix} 1 \\ 4 \\ 1 \end{pmatrix} + \begin{pmatrix} -4 \\ 8 \\ -4 \end{pmatrix} - \begin{pmatrix} -1 \\ -4 \\ -1 \end{pmatrix} = \begin{pmatrix} -2 \\ 16 \\ -2 \end{pmatrix}$$

$$\text{e) } \vec{CD} - \vec{DC} + \vec{BD} = \begin{pmatrix} 6 \\ -3 \\ 3 \end{pmatrix} - \begin{pmatrix} -6 \\ 3 \\ -3 \end{pmatrix} + \begin{pmatrix} 1 \\ 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 13 \\ -2 \\ 7 \end{pmatrix}$$

$$\text{f) } \vec{AC} + \vec{CD} + \vec{DB} = \begin{pmatrix} -4 \\ 8 \\ -4 \end{pmatrix} + \begin{pmatrix} 6 \\ -3 \\ 3 \end{pmatrix} + \begin{pmatrix} -1 \\ -4 \\ -1 \end{pmatrix} = \begin{pmatrix} 1 \\ 1 \\ -2 \end{pmatrix}$$

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## 8 Verschiebung

$$\text{a) } \vec{a} = \begin{pmatrix} 1 \\ -12 \\ 10 \end{pmatrix}, \vec{b} = \begin{pmatrix} -1 \\ 11 \\ -14 \end{pmatrix} \quad \vec{a} + \vec{b} = \begin{pmatrix} 0 \\ -1 \\ -4 \end{pmatrix}$$

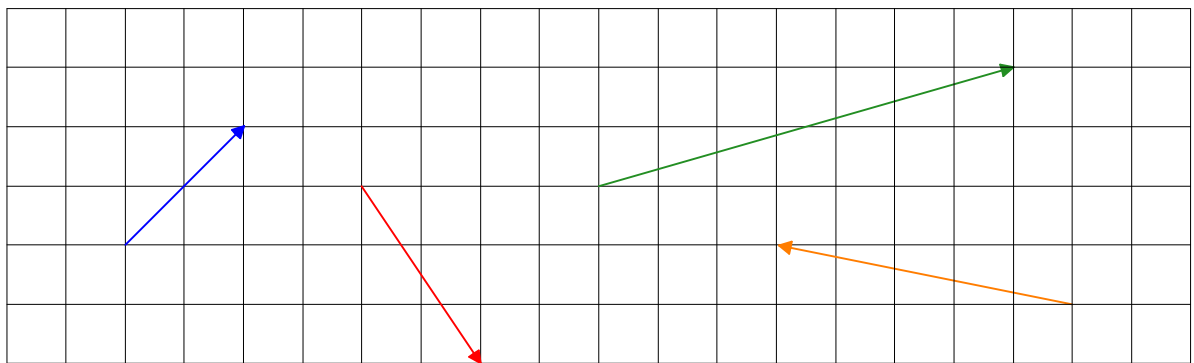
$$\vec{P}' = \begin{pmatrix} 2 \\ 6 \\ -5 \end{pmatrix}, \vec{Q}' = \begin{pmatrix} 3 \\ -5 \\ -9 \end{pmatrix} \text{ und } \vec{R}' = \begin{pmatrix} 2 \\ 5 \\ -9 \end{pmatrix}$$

$$\text{b) } \vec{a} = \begin{pmatrix} -3 \\ 8 \\ 15 \end{pmatrix}, \vec{b} = \begin{pmatrix} -3 \\ -7 \\ 12 \end{pmatrix} \quad \vec{a} + \vec{b} = \begin{pmatrix} -6 \\ 1 \\ 27 \end{pmatrix}$$

$$\vec{P}' = \begin{pmatrix} 5 \\ 1 \\ 25 \end{pmatrix}, \vec{Q}' = \begin{pmatrix} 2 \\ 14 \\ 22 \end{pmatrix} \text{ und } \vec{R}' = \begin{pmatrix} -1 \\ 7 \\ 34 \end{pmatrix}$$

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## 9 Zeichnerische Addition



## 10 Quader

a)

$A(3 2 -1)$	$B(3 6 -1)$	$C(1 6 -1)$	$D(1 2 -1)$
$E(3 2 2)$	$F(3 6 2)$	$G(1 6 2)$	$H(1 2 2)$

b)  $M(3|2|0,5)$ ,  $N(2|6|-1)$  und  $S(1|4|2)$

$$\vec{MN} = \begin{pmatrix} -1 \\ 4 \\ -1,5 \end{pmatrix}, \vec{MS} = \begin{pmatrix} -2 \\ 2 \\ 1,5 \end{pmatrix} \text{ und } \vec{NS} = \begin{pmatrix} -1 \\ -2 \\ 3 \end{pmatrix}$$


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### 11 Darstellung

$$\vec{a} + \vec{z} - \vec{y} = \vec{o} \Rightarrow \vec{a} = \vec{y} - \vec{z}$$

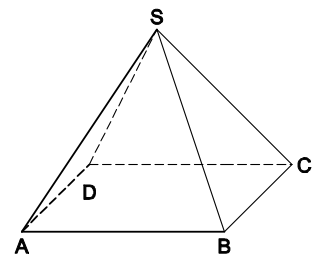
$$\vec{b} + \vec{x} + \vec{a} = \vec{o} \Rightarrow \vec{b} = \vec{z} - \vec{y} - \vec{x}$$

$$\vec{c} = \vec{x} + \vec{y}$$


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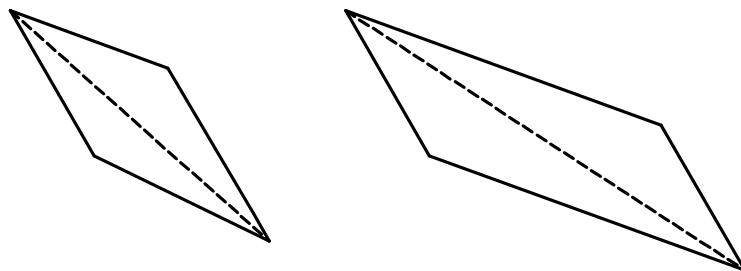
### 12 Pyramide

$$\vec{CS} = \vec{DA} - \vec{AB} + \vec{AS}$$



### 13 Hundeleine

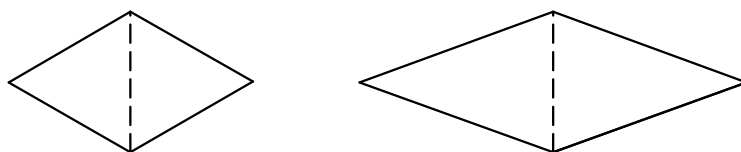
a)



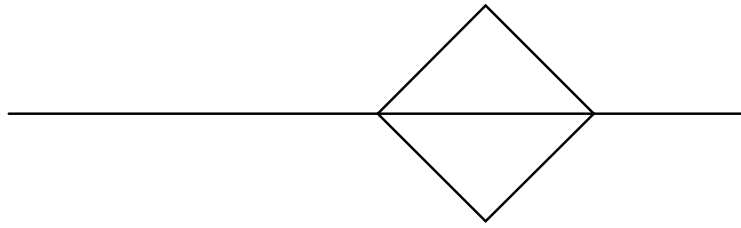
b) 180°

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### 14 Straßenlampe



### 15 Seilziehen



$$\frac{1+\sqrt{2}}{3}$$

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### 16 Winkel zwischen Vektoren

90°

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### G 17 Nullstellen

$f(x) = -2x^2 + 8$	-2	2	
$f(x) = 4x^2 - 4x - 8$	-1	2	
$f(x) = x^3 - 2x^2 + x$	0	1	
$f(x) = 2x^4 - 20x^2$	$-\sqrt{10}$	0	$\sqrt{10}$
$f(x) = 10x^5 + 40x^3$	0		
$f(x) = 8x^2 - 4x - 5x^3 + x^4$	0	1	2
$f(x) = 5x^4 - 45x^2$	-3	0	3

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### G 18 Gleichungssysteme

a)  $L = \{6; 1\}$

b)  $L = \{8; -3\}$

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### G 19 Würfeln

$$P(E) = 1 - \left(\frac{5}{6}\right)^4$$

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