Matthias Apsel November 2009

Die Spurpunkte einer Geraden sind ihre Schnittpunkte mit den Koordinatenebenen.

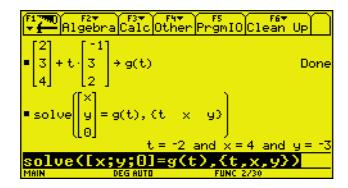
Beispiel:  $g: \bar{x} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix}; t \in \mathbb{R}$ 

Spurpunkt der x-y-Ebene:

$$\begin{pmatrix} x \\ y \\ 0 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix}$$

Die dritte Gleichung liefert t=-2, also x=4 und y=-3. Damit ist der Spurpunkt  $P_{xy}\left(4\mid -3\mid 0\right)$ .

CAS



# Spurpunkt der x-z-Ebene:

$$\begin{pmatrix} x \\ 0 \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix}$$

■ solve 
$$\begin{bmatrix} x \\ 0 \\ z \end{bmatrix}$$
 = g(t), (t x z)  
t = -1 and x = 3 and z = 2  
solve([x;0;z]=g(t),{t,x,z})  
MAIN DEGRATO FUNC 2/30

deshalb  $P_{xz}(3|0|2)$ 

## Spurpunkt der y-z-Ebene

$$\begin{pmatrix} \mathbf{0} \\ \mathbf{y} \\ \mathbf{z} \end{pmatrix} = \begin{pmatrix} \mathbf{2} \\ \mathbf{3} \\ \mathbf{4} \end{pmatrix} + \mathbf{t} \cdot \begin{pmatrix} -1 \\ \mathbf{3} \\ \mathbf{2} \end{pmatrix}$$

■ solve 
$$\begin{bmatrix} 0 \\ y \\ z \end{bmatrix}$$
 = g(t), (t y z)  
t = 2 and y = 9 and z = 8  
solve([0;y;z]=g(t), (t,y,z))

also  $P_{yz}(0|9|8)$ 

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Die Spurpunkte einer Ebene sind ihre Schnittpunkte mit den Koordinatenachsen.

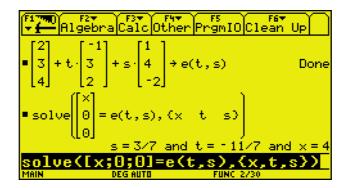
Beispiel: 
$$E: \vec{x} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix} + s \cdot \begin{pmatrix} 1 \\ 4 \\ -2 \end{pmatrix}; t, s \in \mathbb{R}$$

## Spurpunkt der x-Achse:

$$\begin{pmatrix} x \\ 0 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix} + s \cdot \begin{pmatrix} 1 \\ 4 \\ -2 \end{pmatrix}$$

Die beiden letzten Gleichungen liefern  $t=-\frac{11}{7}$  und  $s=\frac{3}{7}$ , also x=4. Damit ist der Spurpunkt  $P_x(4|0|0)$ .

CAS



#### Spurpunkt der y-Achse:

$$\begin{pmatrix} 0 \\ y \\ 0 \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix} + s \cdot \begin{pmatrix} 1 \\ 4 \\ -2 \end{pmatrix}$$

$$\begin{array}{c} \bullet \text{ solve} \begin{pmatrix} 0 \\ y \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}\} \\ \bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}$$
 
$$\bullet \text{ solve} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} = e(t,s), \{y \in t\}$$

Dieses Gleichungssystem besitzt keine Lösung, die Ebene schneidet die y-Achse nicht.

Sie verläuft parallel zur y-Achse und somit senkrecht zur x-z-Ebene.

#### Spurpunkt der z-Achse

$$\begin{pmatrix} 0 \\ 0 \\ z \end{pmatrix} = \begin{pmatrix} 2 \\ 3 \\ 4 \end{pmatrix} + t \cdot \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix} + s \cdot \begin{pmatrix} 1 \\ 4 \\ -2 \end{pmatrix}$$

$$s = -9/7 \text{ and } t = 5/7 \text{ and } z = 8$$

$$solve([0;0;z] = e(t,s), (z,t,s))$$

$$s = -9/7 \text{ and } t = 5/7 \text{ and } z = 8$$

$$solve([0;0;z] = e(t,s), (z,t,s))$$

also  $P_z(0|0|8)$