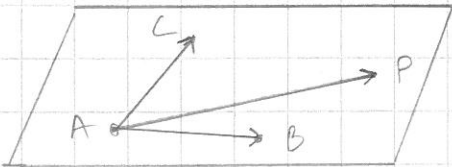


$$= (1,8; 4,6; 1,2)$$

$\Rightarrow$  korkeus: 1,2 km

## 8. teorunden taso

Kolme pistettä  $A, B$  ja  $C$  määräävät tason (joka ei ole samalla suoralla)



$$P \text{ on tasolla} \Leftrightarrow \overrightarrow{AP} = r\overrightarrow{AB} + t\overrightarrow{AC}$$

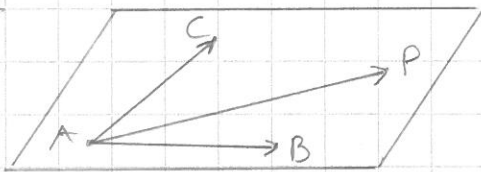
↑ ↑  
tason suuntavektorit

$$\Rightarrow P = (\dots, \dots, \dots)$$

$$\Rightarrow \begin{cases} x = \dots \\ y = \dots \\ z = \dots \end{cases} \quad (\text{tason parametrisointityyppi})$$

Esim. Pistet  $A = (2, -1, 1)$ ,  $B = (2, 0, 3)$  ja  $C = (4, 2, 0)$  määräävät tason. Onko piste  $D = (3, -2, 2)$  tasolla? Mikä pisteen taso leikkaa  $z$ -akselin?

Ratk.



$$A = (2, -1, 1), B = (2, 0, 3), C = (4, 2, 0)$$

$$D = (3, -2, 2)$$

$$P \text{ on tasolla} \Leftrightarrow \overrightarrow{AP} = r\overrightarrow{AB} + t\overrightarrow{AC}$$

$$\Leftrightarrow \overrightarrow{AP} = r(\vec{j} + 2\vec{k}) + t(2\vec{i} + 3\vec{j} - \vec{k})$$

$$= 2t\vec{i} + (r + 3t)\vec{j} + (2r - t)\vec{k}$$

$$\Rightarrow P = (2 + 2t, -1 + r + 3t, 1 + 2r - t)$$

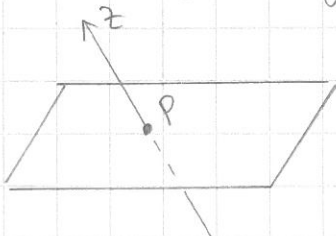
$$D = (3, -2, 2) \text{ on tasolla} \Leftrightarrow \begin{cases} 2 + 2t = 3 & (1) \\ -1 + r + 3t = -2 & (2) \\ 1 + 2r - t = 2 & (3) \end{cases}$$

$$(1) \text{ ja } (2): \begin{cases} 2 + 2t = 3 & \Leftrightarrow t = \frac{1}{2} \\ -1 + r + 3t = -2 & \leftarrow \end{cases}$$

$$\Rightarrow -1 + r + 3 \cdot \frac{1}{2} = -2 \Leftrightarrow r = -\frac{5}{2}$$

$$\text{Tark. (3):} \text{ ker: } 1 + 2 \cdot \left(-\frac{5}{2}\right) - \frac{1}{2} = 2 \Leftrightarrow -\frac{9}{2} = 2 \quad \nabla$$

$\Rightarrow$  yhtälöryhmällä ei ole ratk.  $\Rightarrow$   $D$  ei ole tasolla



$$P \text{ on } z\text{-akselilla} \Leftrightarrow \begin{cases} x = 2 + 2t = 0 & \Leftrightarrow t = -1 \\ y = -1 + r + 3t = 0 & \leftarrow \end{cases}$$

$$\Rightarrow r = 1 - 3 \cdot (-1) = 4$$

$$\Rightarrow P = (2 + 2 \cdot (-1), -1 + 4 + 3 \cdot (-1), 1 + 2 \cdot 4 - (-1)) \\ = (0, 0, 10)$$