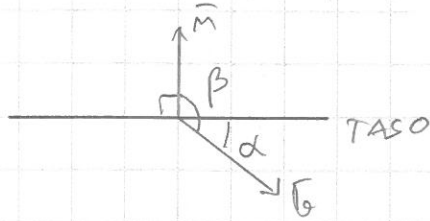


$$\cos(\vec{l}_6, \vec{m}) = \frac{\vec{l}_6 \cdot \vec{m}}{|\vec{l}_6| |\vec{m}|} = \frac{1 \cdot 3 + 5 \cdot (-2) + (-3) \cdot 1}{\sqrt{1^2 + 5^2 + (-3)^2} \sqrt{3^2 + (-2)^2 + 1^2}} = \frac{-10}{\sqrt{35} \sqrt{14}}$$

$$\Rightarrow \angle(\vec{l}_6, \vec{m}) = \beta \approx 116,86^\circ \approx 117^\circ$$

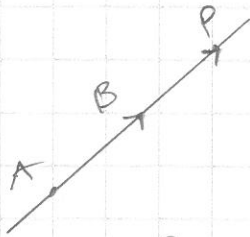


$\Rightarrow$ suoranjäksen normaalin kulma

$$\alpha = \beta - 90^\circ \approx 27^\circ$$

3.13

$$A = (14,5; 14,5; 1), B = (12; 12; 0,8)$$



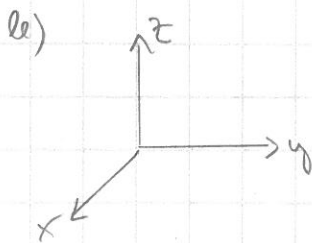
Piste P on ^{suoralla} $\overline{AP} \parallel \overline{AB}$

$$\Rightarrow \overline{AP} = t \overline{AB} = t(-2,5\vec{i} - 2,5\vec{j} - 0,2\vec{k}) = -2,5t\vec{i} - 2,5t\vec{j} - 0,2t\vec{k}$$

$$\Rightarrow P = (14,5 - 2,5t, 14,5 - 2,5t, 1 - 0,2t), t \geq 0$$

a) P on xy-tasolla: $z = 1 - 0,2t = 0 \Rightarrow t = 5$

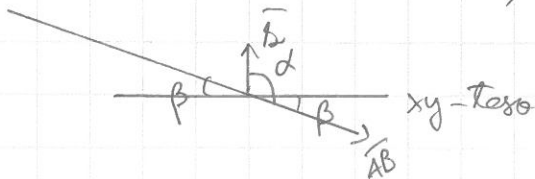
$$\Rightarrow P = (14,5 - 2,5 \cdot 5, 14,5 - 2,5 \cdot 5, 1 - 0,2 \cdot 5) = (2, 2, 0)$$



xy-tason normaalivektori: $\vec{z}$

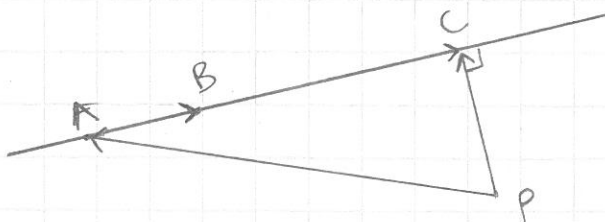
$$\cos(\overline{AB}, \vec{z}) = \frac{\overline{AB} \cdot \vec{z}}{|\overline{AB}| |\vec{z}|} = \frac{-2,5 \cdot 0 + (-2,5) \cdot 0 + (-0,2) \cdot 1}{\sqrt{(-2,5)^2 + (-2,5)^2 + (-0,2)^2} \cdot 1} = \frac{-0,2}{\sqrt{12,54}}$$

$$\Rightarrow \angle(\overline{AB}, \vec{z}) \approx 93,24^\circ \approx 93,2^\circ = \alpha$$



$$\Rightarrow \text{kyötytty kulma: } \alpha - 90^\circ \approx 3,2^\circ = \beta$$

10. Pisten etäisyys suorasta

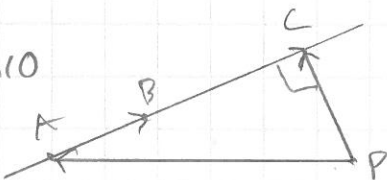


$$\overline{PC} = \overline{PA} + \overline{AC} = \overline{PA} + t \overline{AB}$$

$$\overline{PC} \perp \overline{AB} \Leftrightarrow \overline{PC} \cdot \overline{AB} = 0 \Leftrightarrow t = \dots$$

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

10.10



$$A = (1, -4, 3), B = (-1, -7, 2), P = (-1, 2, 3)$$

$$\overline{PC} = \overline{PA} + \overline{AC} = \overline{PA} + t \overline{AB}$$

$$= (2\vec{i} - 6\vec{j}) + t(-2\vec{i} - 3\vec{j} - \vec{k})$$

$$= (2 - 2t)\vec{i} + (-6 - 3t)\vec{j} - t\vec{k}$$

$$\overline{AB} \perp \overline{PC} \Leftrightarrow \overline{AB} \cdot \overline{PC} = -2 \cdot (2 - 2t) - 3 \cdot (-6 - 3t) - 1 \cdot (-t) = 0$$

$$\Leftrightarrow 14t + 14 = 0 \Leftrightarrow t = -1$$