AKADEMIA EDUKACYJNO - INŻYNIERSKA

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MATURA STUDIA PRAKTYKA STAŻ PRACA BIZNES PRZEMYSŁ STEAM

KOMPLEKSOWE WSPARCIE EDUKACYJNE **ON – LINE** NA KAŻDYM ETAPIE KSZTAŁCENIA INŻYNIERSKIEGO

email: **kontakt@e-mechanik.com.pl**
web: **www.e-MECHANiK.com.pl**
fb: www.facebook.com/groups/emechanik
tel: **(+48) - 697-165-075**

MECHANIKA I

"STATECZNOŚĆ UKŁADU"

PROJEKT

Oblicz:

- stateczność względem koła
- stateczność względem podpory

dla układu dźwigu mobilnego znajdującego się na podłożu horyzontalnym oraz na równi pochyłej.

DANE:

1) $m_1 = OK$
2) $m_2 = OK$
3) $m_3 = OK$

SZUKAM:

h_3 , $H_3 = ?$

SL

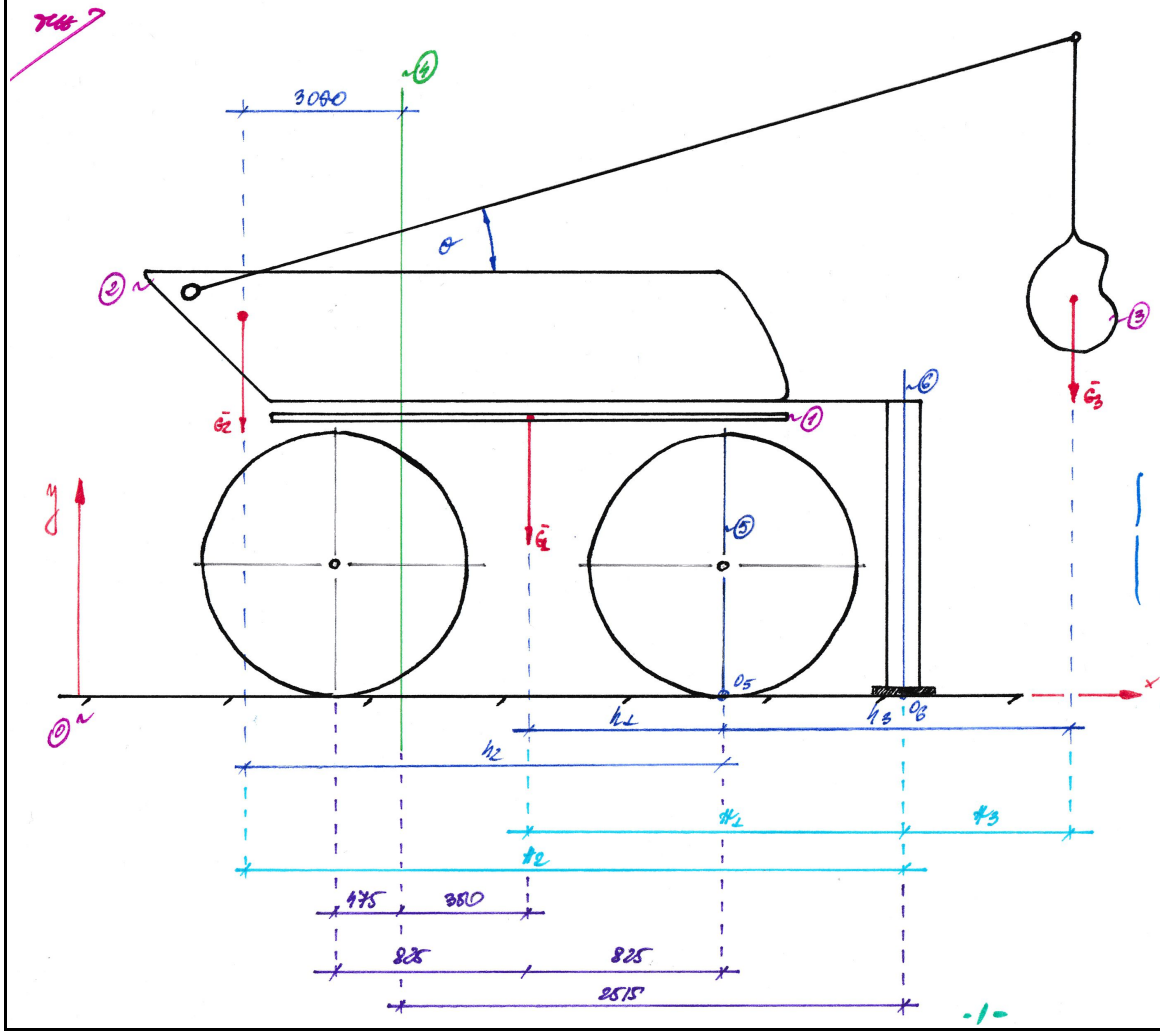
D: $m_1 = 46\ [t] = 46\,000\ [kg]$

$m_2 = 12\ [t] = 12\,000\ [kg]$

$m_3 = 10\ [t] = 10\,000\ [kg]$

Sz: $h_3 = ?$

1) schemat statycznego układu.



2) obliczenia - wzory:

$\sum M_{O5} = 0 \quad \Rightarrow \quad M_W \geq M_U$

$\Rightarrow G_3 \cdot h_3 \geq G_1 \cdot h_1 + G_2 \cdot h_2$

$h_3 \geq \frac{G_1 \cdot h_1 + G_2 \cdot h_2}{G_3}$

$h_3 \geq \frac{m_1 g h_1 + m_2 g h_2}{m_3 g}$

$h_3 \geq \frac{m_1 h_1 + m_2 h_2}{m_3}$

$h_1 = 825\ [mm] = 0{,}825\ [m]$

$h_2 = 825 + 350 + 3080 = 4225\ [mm] = 4{,}225\ [m]$

$\Rightarrow h_3 \geq \frac{46\,000 \cdot 0{,}825 + 12000 \cdot 4{,}225}{10\,000} =$

$= \frac{37\,950 + 50\,700}{10\,000} = \frac{88\,650}{10\,000} =$

$= 8{,}865 \quad \Rightarrow \quad h_3 \geq 8{,}865\ [m]$

-1-

$\sum M_{OB} = 0 \quad \Rightarrow \quad M_N \geq M_u$

$\Rightarrow \quad G_3 \cdot H_3 \geq G_1 \cdot H_1 + G_2 \cdot H_2$

$$H_3 \geq \frac{G_1 \cdot H_1 + G_2 \cdot H_2}{G_3}$$

$$H_3 \geq \frac{m_1 g H_1 + m_2 g H_2}{m_3 g}$$

$$H_3 \geq \frac{m_1 H_1 + m_2 H_2}{m_3}$$

$H_1 = 2515 - 350 = 2165 \ [mm] = 2{,}165 \ [m]$

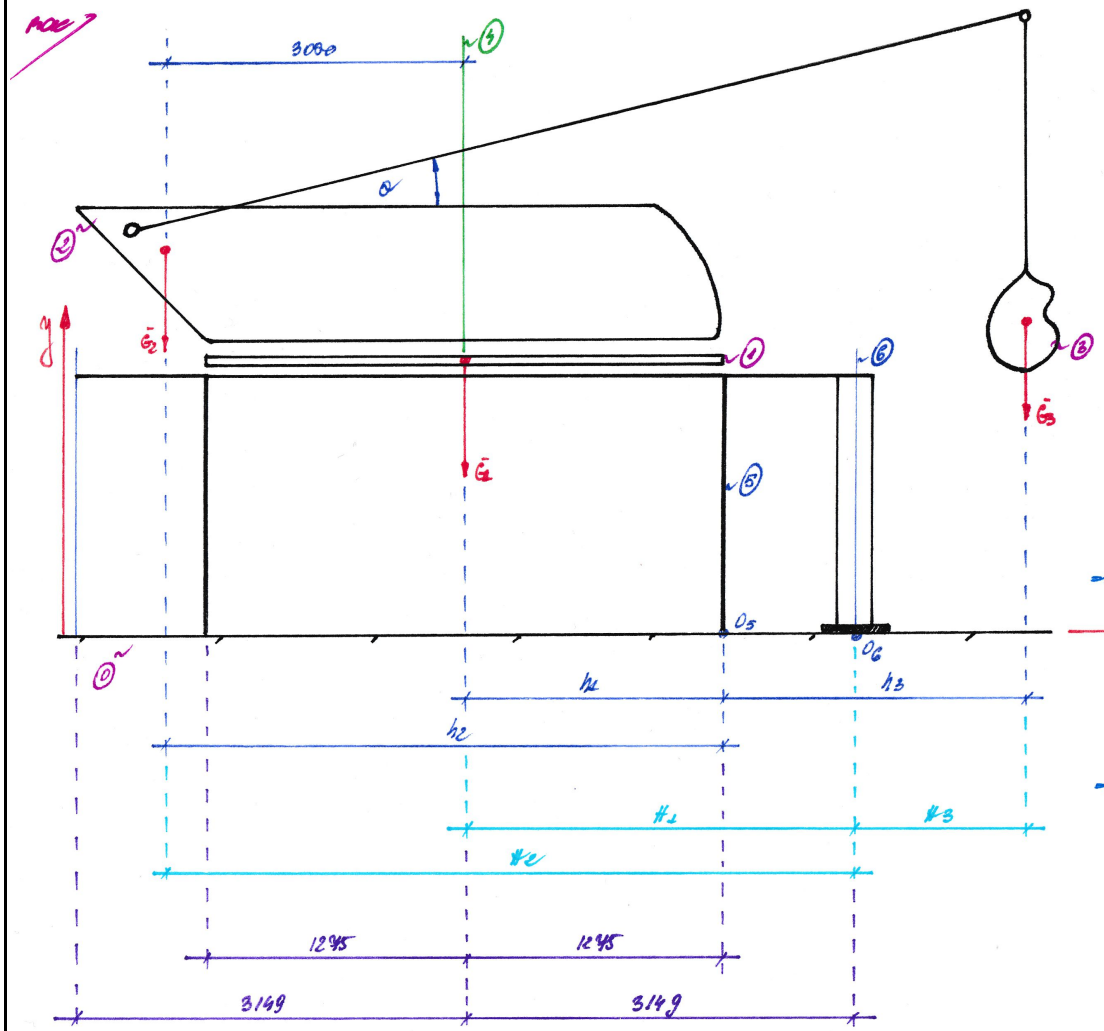
$H_2 = 2515 + 3000 = 5565 \ [mm] = 5{,}565 \ [m]$

$$\Rightarrow \quad H_3 \geq \frac{46\,000 \cdot 2{,}165 + 12\,000 \cdot 5{,}565}{10\,000} =$$

$$= \frac{99\,680 + 66\,480}{10\,000} = \frac{166\,370}{10\,000} = 16{,}634 \ [m]$$

$\Rightarrow \begin{cases} h_3 \geq 8{,}865 \ [m] \\ H_3 \geq 16{,}634 \end{cases}$

3) zamknięty statycznie układ.



4) obliczenia - w pamięci.

$\sum M_{O5} = 0 \quad \Rightarrow \quad M_W \geq M_U$

$\Rightarrow \quad h_3 \geq \frac{m_1 h_1 + m_2 h_2}{m_3}$

$h_1 = 1245 \text{ [mm]} = 1,245 \text{ [m]}$

$h_2 = 1245 + 3000 = 4325 \text{ [mm]} = 4,325 \text{ [m]}$

$\Rightarrow \quad h_3 \geq \frac{46000 \cdot 1,245 + 12000 \cdot 4,325}{10\,000} =$

$= \frac{57\,270 + 51\,900}{10\,000} = \frac{110\,550}{10\,000} = 11,055 \text{ [m]}$

$\Rightarrow \quad h_3 \geq 11,055 \text{ [m]}$

Aoc 7

$\frac{1}{3} M_{66} = 0$ — $M_w \geq M_u$

— $h_3 \geq \frac{m_1 h_1 + m_2 h_2}{m_3}$

$h_1 = 3149 \text{ [mm]} = 3,149 \text{ [m]}$

$h_2 = 3149 + 3050 = 6199 \text{ [mm]} = 6,199 \text{ [m]}$

— $h_3 \geq \frac{46000 \cdot 3,149 + 12000 \cdot 6,199}{10\,000} =$

$= \frac{144\,854 + 74\,388}{10\,000} =$

$= \frac{218\,242}{10\,000} = 21,9242 \text{ [m]}$

— $h_3 \geq 21,9242 \text{ [m]}$

— $\begin{cases} h_3 \geq 11,055 \text{ [m]} \\ h_3 \geq 21,9242 \end{cases}$

-4-

8c)

D: $m_1 = 46\ [t] = 46\,000\ [kg]$

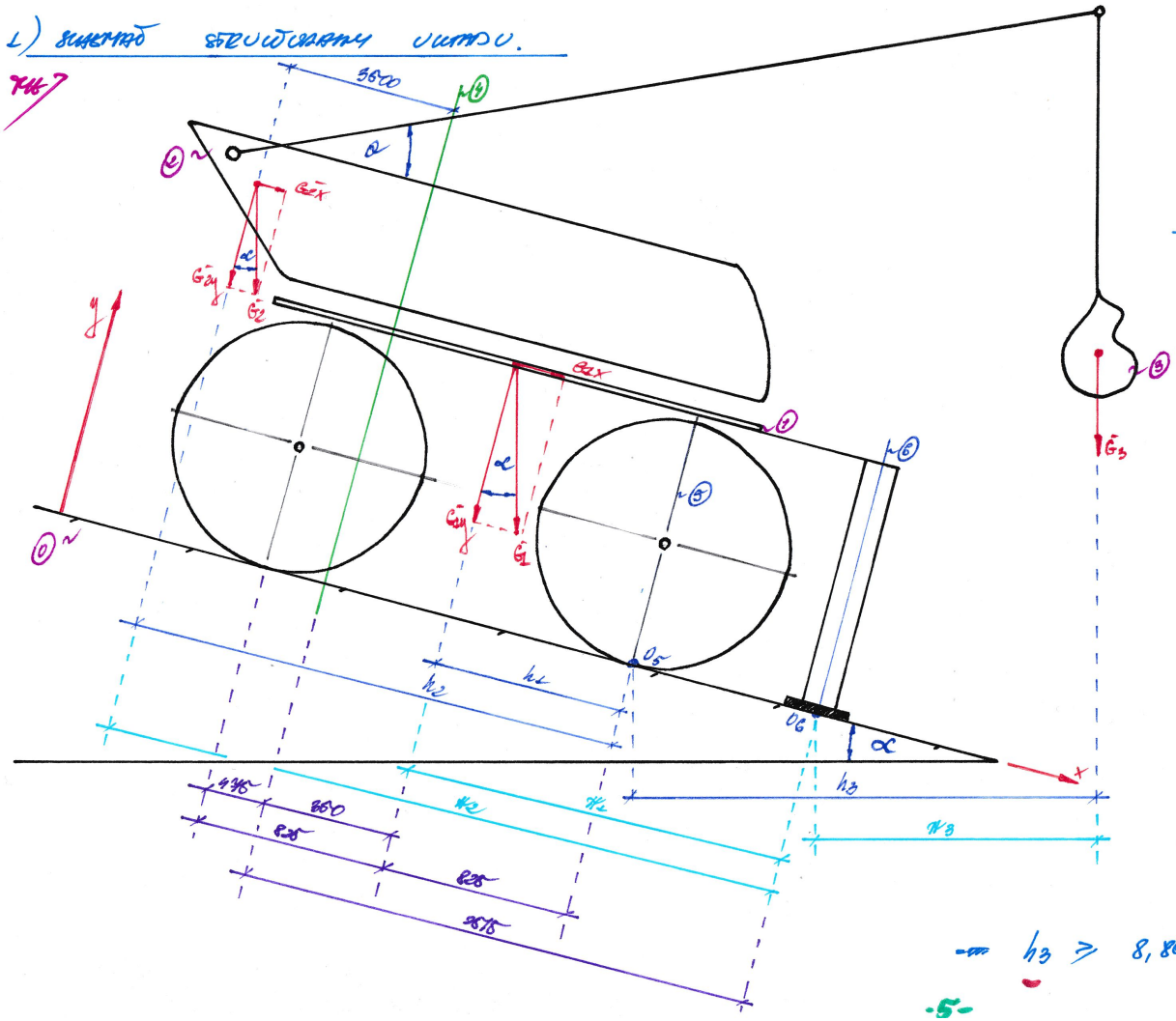
$m_2 = 12\ [t] = 12\,000\ [kg]$

$m_3 = 10\ [t] = 10\,000\ [kg]$

$\alpha = 15^\circ$

32: $h_3 = ?$

1) schemat sporządzonej ciężaru.



2) obliczenia - wzory.

$\sum M_{0S} = 0 \quad \Rightarrow \quad M_W \geq M_u$

$\Rightarrow G_3 \cdot h_3 \geq G_{2y} \cdot h_1 + G_{1y} \cdot h_2$

$h_3 \geq \frac{G_{1y} \cdot h_1 + G_{1y} \cdot h_2}{G_3}$

$\frac{G_{1y}}{G_1} = \cos\alpha \quad \Rightarrow \quad G_{1y} = m_1 g \cos\alpha$

$\frac{G_{2y}}{G_2} = \cos\alpha \quad \Rightarrow \quad G_{2y} = m_2 g \cos\alpha$

$h_3 \geq \frac{(m_1 g h_1 + m_2 g h_2)\cos\alpha}{m_3 g}$

$\Rightarrow h_3 \geq \frac{(m_1 h_1 + m_2 h_2)\cos\alpha}{m_3}$

$h_1 = 825\ [mm] = 0{,}825\ [m]$

$h_2 = 4225\ [mm] = 4{,}125\ [m]$

$\Rightarrow h_3 \geq 8{,}865 \cdot \cos 15^\circ = 8{,}562\ [m] \quad \Rightarrow \quad h_3 \geq 8{,}562\ [m]$

-5-

Хай

$\sum M_{OB} = 0 \quad \Rightarrow \quad M_N \geq M_{kr}$

$\Rightarrow \quad G_3 \cdot h_3 \geq G_{1y} \cdot h_1 + G_{2y} \cdot h_2$

$h_3 \geq \frac{G_{1y} \cdot h_1 + G_{2y} \cdot h_2}{G_3}$

$h_3 \geq \frac{(m_1 g h_1 + m_2 g h_2)\cos\alpha}{m_3 g}$

$h_3 \geq \frac{(m_1 h_1 + m_2 h_2)\cos\alpha}{m_3}$

$h_1 = 2165 \text{ (mm)} = 2{,}165 \text{ (m)}$

$h_2 = 6565 \text{ (mm)} = 6{,}565 \text{ (m)}$

$\Rightarrow \quad h_3 \geq 10{,}634 \cdot \cos 15^\circ = 10{,}040 \text{ (m)}$

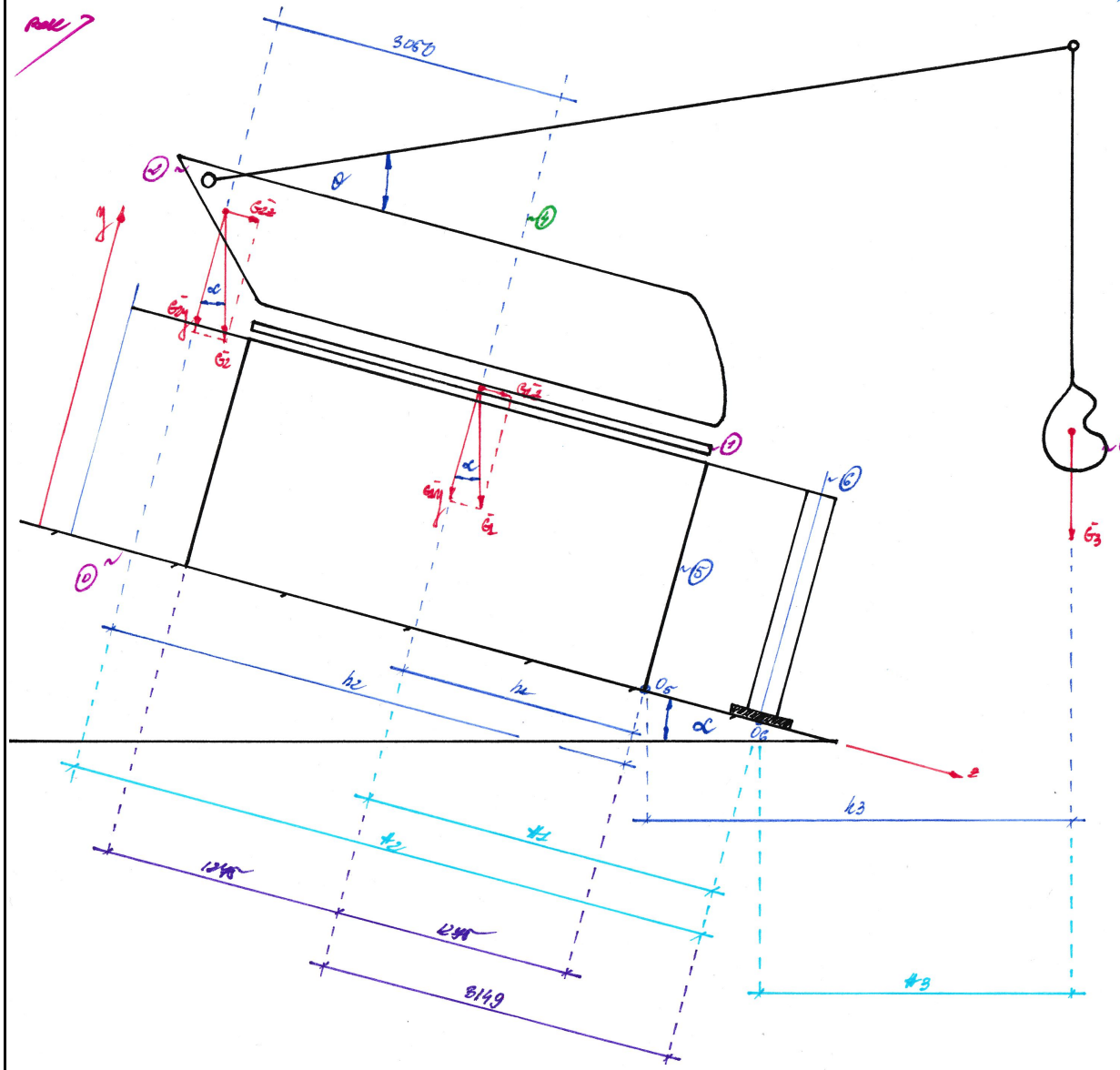
$\Rightarrow \quad h_3 \geq 10{,}040 \text{ (m)}$

$\Rightarrow \quad h_3 \geq 8{,}662 \text{ (m)}$

$h_3 \geq 10{,}040$

-6-

3) SCHEMAT STATYCZNY UKŁADU.



4) OBLICZENIA - W DOPISKU

$\sum M_{O5} = 0$ ⟹ $M_W \geq M_U$

⟹ $h_3 \geq \frac{(m_1 h_1 + m_2 h_2)\cos\alpha}{m_3}$

$h_1 = 1245\ [mm] = 1{,}245\ [m]$

$h_2 = 4325\ [mm] = 4{,}325\ [m]$

⟹ $h_3 \geq 11{,}055 \cdot \cos 15^{\circ} = 10{,}678\ [m]$

⟹ $h_3 \geq 10{,}678\ [m]$

-6-

$\sum M_{O6} = 0$ — $M_N \geq M_H$

— $h_3 \geq \frac{(m_1 h_1 + m_2 h_2)\cos\alpha}{m_3}$

$h_1 = 3149 \ [mm] = 3,149 \ [m]$

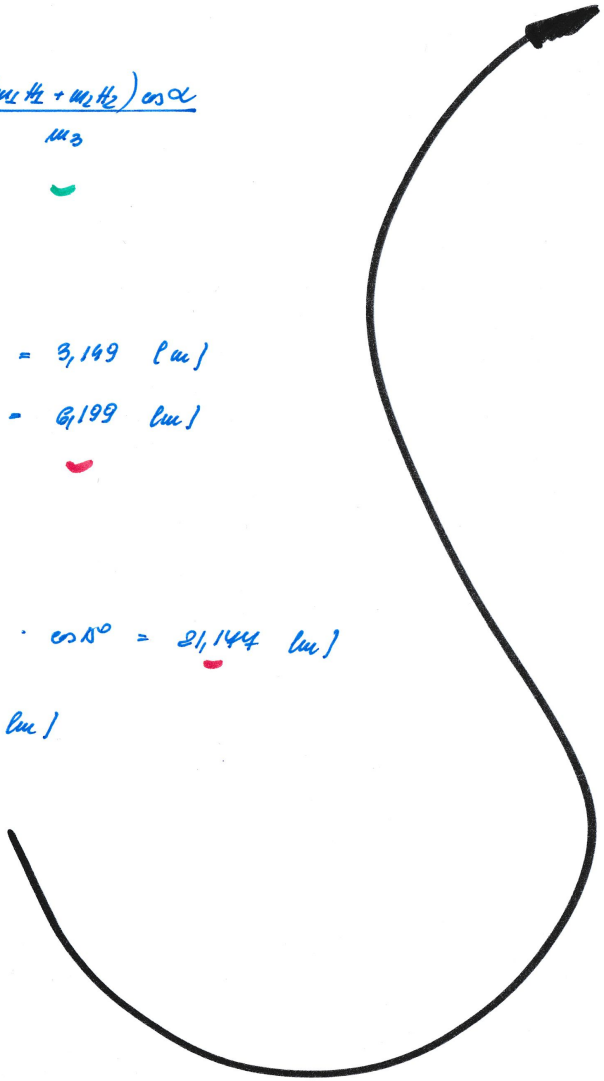
$h_2 = 6199 \ [mm] = 6,199 \ [m]$

— $h_3 \geq 21,9242 \cdot \cos 5^\circ = 21,144 \ [m]$

— $h_3 \geq 21,144 \ [m]$

— $h_3 \geq 10,648 \ [m]$

$h_3 \geq 21,144$

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