

TBM 2, 31.5. / 1.6. 2012

①

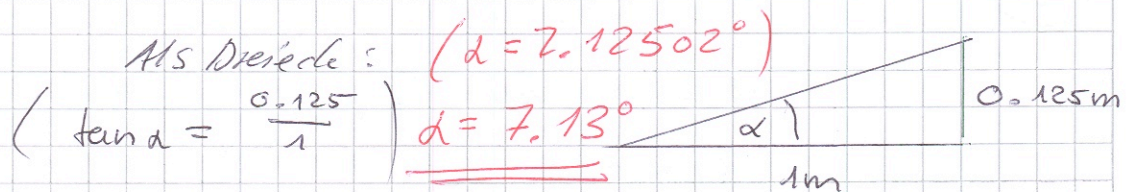
a)  $a = 12.5\% = 0.125$

12.5% heisst, pro Meter horizontal werden 0.125m = 12.5cm vertikale Höhe überwunden:

0.125m pro Meter

600 - 0.125m pro 600 Meter

= 75m

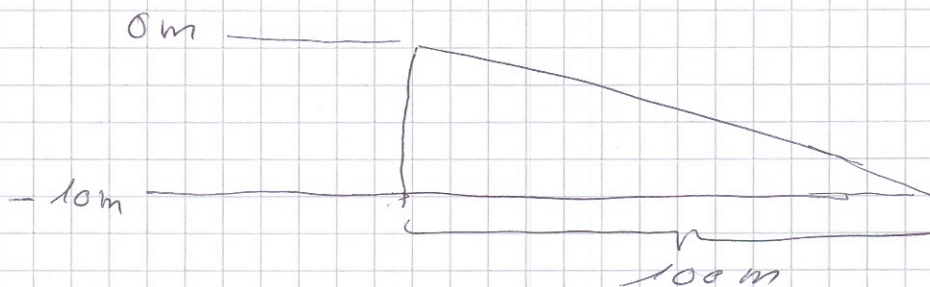


b)  $\alpha = 10^\circ$

Steigung =  $\tan \alpha \cdot 100\% = 17.63\%$

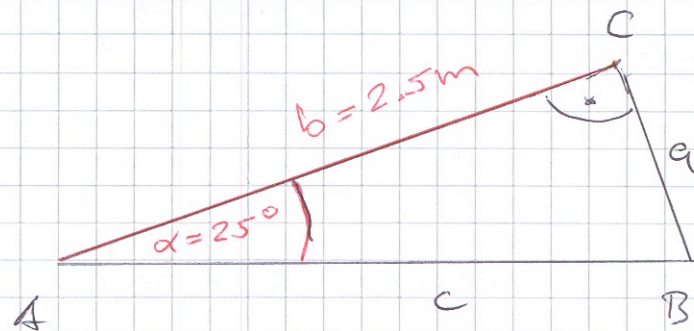
17.632698

c) Gefälle (von links nach rechts, d.h. in Richtung der pos. x-Achse)



$a = -10\%$

2



$$\cos \alpha = \frac{AK}{AC} = \frac{b}{c} \Rightarrow c = \frac{b}{\cos \alpha} = \underline{\underline{2.758 \text{ m}}}$$

$$\tan \alpha = \frac{BK}{AK} = \frac{a}{b} \Rightarrow a = b \cdot \tan \alpha$$

$$\beta = 90^\circ - \alpha = \underline{\underline{65^\circ}} = \underline{\underline{1.166 \text{ m}}}$$

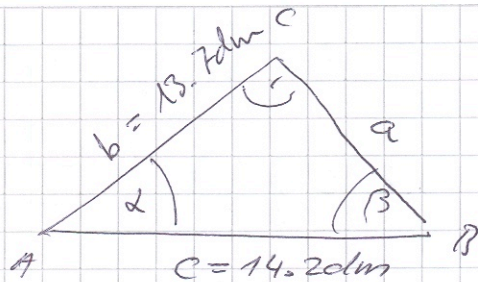
3

$$\cos \alpha = \frac{b}{c} = \frac{13.7}{14.2}$$

$$\alpha = \arccos\left(\frac{13.7}{14.2}\right)$$

$$\alpha = \underline{\underline{15.25^\circ}}$$

$$\beta = \underline{\underline{74.75^\circ}}$$



$$\sin \alpha = \frac{a}{c} \quad 3.735 \text{ dm}$$

$$a = c \cdot \sin \alpha = \underline{\underline{3.73 \text{ dm}}}$$

(3.73496)

4)  $1.25 \cdot b = c$ ,  $U = a + b + c = 3.6 \text{ m}$

$$\cos \alpha = \frac{b}{c} = \frac{b}{1.25b} = \frac{1}{1.25} = \frac{4}{5}$$

$$\alpha = \arccos\left(\frac{4}{5}\right) = \underline{\underline{36.87^\circ}}$$

$$\beta = \underline{\underline{53.13^\circ}}$$

Setze  $b' = 4 \Rightarrow c' = 1.25 \cdot b' = 5$

$$\sin \alpha = \frac{a'}{c'} \Rightarrow a' = c' \cdot \sin \alpha = 3$$

$$a' : b' : c' = 3 : 4 : 5 = a : b : c$$

12 Teile

$$a = \frac{3.6 \text{ m}}{12} \cdot 3 = \underline{\underline{0.9 \text{ m}}}$$

$$b = \frac{3.6}{12} \cdot 4 = \underline{\underline{1.2 \text{ m}}}$$

$$c = \frac{3.6}{12} \cdot 5 = \underline{\underline{1.5 \text{ m}}}$$

Check:

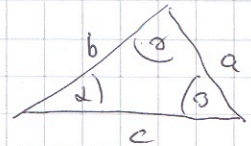
$$0.9^2 + 1.2^2 = 1.5^2$$

$$5 \quad c^2 = a^2 + b^2 - 2ab \cdot \cos \gamma$$

$$\cos \gamma = \frac{c^2 - a^2 - b^2}{-2ab}$$

$$\gamma = \arccos \left( \frac{c^2 - a^2 - b^2}{-2ab} \right)$$

$$\gamma = \underline{\underline{80.01^\circ}}$$



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$$a^2 = b^2 + c^2 - 2bc \cdot \cos \alpha$$

$$\alpha = \arccos \left( \frac{a^2 - b^2 - c^2}{-2bc} \right)$$

$$\alpha = \underline{\underline{44.44^\circ}}$$

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$$b^2 = a^2 + c^2 - 2ac \cdot \cos \beta$$

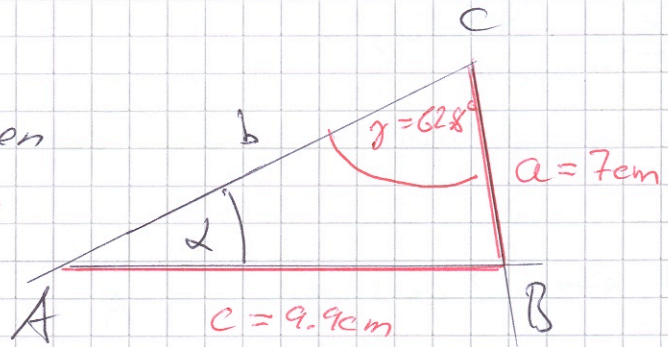
$$\beta = \arccos \left( \frac{b^2 - a^2 - c^2}{-2ac} \right)$$

$$\beta = \underline{\underline{55.55^\circ}}$$

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6

SSWg:  $\gamma$  liegt gegenüber  
von  $c$ ,  $c > a$



$$d: \frac{\sin d}{a} = \frac{\sin \gamma}{c}$$

$$d = \arcsin\left(\frac{a \cdot \sin \gamma}{c}\right) = \underline{\underline{38.97^\circ}}$$

$$\beta = 180^\circ - d - \gamma = \underline{\underline{78.23^\circ}}$$

$$b: \frac{b}{\sin \beta} = \frac{a}{\sin d}$$

$$b = \frac{a \cdot \sin \beta}{\sin d} = \underline{\underline{10.9 \text{ cm}}}$$

8

$$\sin \gamma = 0.5$$

$$\gamma = \arcsin(0.5) = 30^\circ = \gamma_1$$

$$\text{ABER: } \sin \gamma = \sin(180^\circ - \gamma) \quad !$$

↳ 2. Lösung kleont:

$$d_2 = 180^\circ - \gamma_1 = 180^\circ - 30^\circ = \underline{\underline{150^\circ}}$$

$$\gamma = 150^\circ, \quad d = \beta = 15^\circ$$

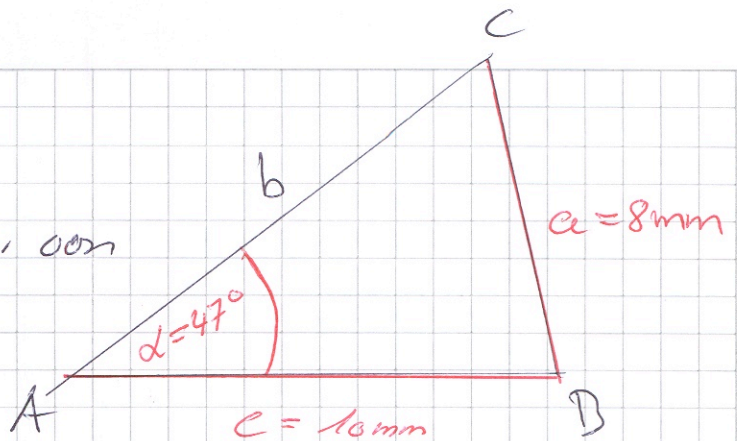
$$\begin{array}{l} \sin \gamma = 0.1 \quad \gamma_1 = \arcsin(0.1) = 5.74^\circ / 0.995 \\ \gamma_2 = 180^\circ - \gamma_1 = 174.3^\circ / -0.995 \end{array}$$

⑦ SSW<sub>k</sub>:

$d$  liegt gegenüber von

$a$ ,  $a < c$

↳ 2 Lösungen!



$\gamma$  berechnen:

$$\frac{\sin d}{a} = \frac{\sin \gamma}{c}$$

$$\sin \gamma = \frac{c \cdot \sin d}{a}$$

$$\gamma_1 = \arcsin\left(\frac{c \cdot \sin d}{a}\right) = 66.091^\circ \\ \approx \underline{\underline{66.1^\circ}}$$

$$\gamma_2 = 180^\circ - \gamma_1 = 113.909^\circ \\ \approx \underline{\underline{113.91^\circ}}$$

Lösung 1:

$$d = 47^\circ, \beta_1 = 66.91^\circ, \gamma_1 = 66.1^\circ$$

$$a = 8 \text{ mm}, c = 10 \text{ mm}$$

$$b_1: \frac{b_1}{\sin \beta_1} = \frac{a}{\sin d}$$

$$b_1 = \frac{a \cdot \sin \beta_1}{\sin d}$$

$$\underline{\underline{b_1 = 10.06 \text{ mm}}}$$

Lösung 2:

$$d = 47^\circ, \beta_2 = 19.1^\circ, \gamma_2 = 113.91^\circ$$

$$a = 8 \text{ mm}, c = 10 \text{ mm}$$

$$b_2: \frac{b_2}{\sin \beta_2} = \frac{a}{\sin d}$$

$$b_2 = \frac{a \cdot \sin \beta_2}{\sin d}$$

$$b_2 = 3.58 \text{ mm}$$

$$\underline{\underline{= 3.6 \text{ mm}}}$$