

1.3 Trigonometrie

$$1. \quad \alpha + \beta + \gamma = 180^\circ; \frac{a}{\sin \alpha} = \frac{b}{\sin \beta};$$

$$a) \quad \gamma = 180^\circ - 37^\circ - 47^\circ = 96^\circ;$$

$$b = \frac{a \cdot \sin \beta}{\sin \alpha} \Rightarrow b = \frac{119 \text{ mm} \cdot \sin 47^\circ}{\sin 37^\circ} = \mathbf{144,61 \text{ mm}}; \quad c = \frac{a \cdot \sin \gamma}{\sin \alpha} \Rightarrow c = \frac{119 \text{ mm} \cdot \sin 96^\circ}{\sin 37^\circ} = \mathbf{196,65 \text{ mm}}$$

$$b) \quad 20' \triangleq \frac{1^\circ \cdot 20'}{60'} = 0,3^\circ; \beta = 53^\circ 20' \Rightarrow 53,3^\circ; \frac{b}{\sin \beta} = \frac{c}{\sin \gamma};$$

$$\frac{c}{\sin \gamma} = \frac{b}{\sin \beta} \Leftrightarrow \sin \gamma = \frac{c \cdot \sin \beta}{b} \Rightarrow \sin \gamma = \frac{380 \text{ mm} \cdot \sin 53,33^\circ}{470 \text{ mm}} = 0,648 \Rightarrow \sin \gamma \text{ (inv.)} = \gamma = \mathbf{40,43^\circ};$$

$$\alpha = 180^\circ - 53,33^\circ - 40,43^\circ = \mathbf{86,24^\circ}; \quad \alpha = \frac{b \cdot \sin \alpha}{\sin \beta} \Rightarrow \alpha = \frac{470 \text{ mm} \cdot \sin 86,24^\circ}{\sin 53,33^\circ} = \mathbf{584,71 \text{ mm}}$$

$$c) \quad \alpha = 180^\circ - 35,7^\circ - 23,3^\circ = \mathbf{121^\circ};$$

$$b = \frac{a \cdot \sin \beta}{\sin \alpha} \Rightarrow b = \frac{320 \text{ mm} \cdot \sin 35,7^\circ}{\sin 121^\circ} = \mathbf{217,85 \text{ mm}};$$

$$c = \frac{a \cdot \sin \gamma}{\sin \alpha} \Rightarrow b = \frac{320 \text{ mm} \cdot \sin 23,3^\circ}{\sin 121^\circ} = \mathbf{147,67 \text{ mm}}$$

$$d) \quad 40' \triangleq \frac{1^\circ \cdot 40'}{60'} = 0,6^\circ; \gamma = 36^\circ 40' \Rightarrow 36,6^\circ; \alpha = 180^\circ - 104^\circ - 36,67^\circ = \mathbf{39,33^\circ}; \quad \frac{a}{\sin \alpha} = \frac{b}{\sin \beta};$$

$$b = \frac{a \cdot \sin \beta}{\sin \alpha} \Rightarrow b = \frac{80 \text{ mm} \cdot \sin 104^\circ}{\sin 39,33^\circ} = \mathbf{122,48 \text{ mm}}; \quad c = \frac{a \cdot \sin \gamma}{\sin \alpha} \Rightarrow c = \frac{80 \text{ mm} \cdot \sin 36,67^\circ}{\sin 39,33^\circ} = \mathbf{75,38 \text{ mm}}$$

$$e) \quad a^2 = b^2 + c^2 - 2bc \cdot \cos \alpha \Leftrightarrow a = \sqrt{b^2 + c^2 - 2bc \cdot \cos \alpha}; \quad 20' \triangleq \frac{1^\circ \cdot 20'}{60'} = 0,3^\circ; \quad \alpha = 99^\circ 20' \Rightarrow \mathbf{99,3^\circ};$$

$$\Rightarrow a = \sqrt{1225^2 \text{ cm}^2 + 844^2 \text{ cm}^2 - 2 \cdot 1225 \text{ cm} \cdot 844 \text{ cm} \cdot \cos 99,33^\circ} = \mathbf{1596,31 \text{ cm}};$$

$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} \Leftrightarrow \sin \beta = \frac{b \cdot \sin \alpha}{a} \Rightarrow \sin \beta = \frac{1225 \text{ mm} \cdot \sin 99,33^\circ}{1596,31 \text{ mm}} = 0,757 \Rightarrow \sin \beta \text{ (inv.)} = \beta = \mathbf{49,22^\circ};$$

$$\alpha + \beta + \gamma = 180^\circ; \Rightarrow \gamma = 180^\circ - 99,3^\circ - 49,22^\circ = \mathbf{31,45^\circ}$$

$$f) \quad a^2 = b^2 + c^2 - 2bc \cdot \cos \alpha \Leftrightarrow \cos \alpha = \frac{b^2 + c^2 - a^2}{2bc};$$

$$\Rightarrow \cos \alpha = \frac{916^2 \text{ mm}^2 + 1024^2 \text{ mm}^2 - 716^2 \text{ mm}^2}{2 \cdot 916 \text{ mm} \cdot 1024 \text{ mm}} = 0,733 \Rightarrow \cos \alpha \text{ (inv.)} = \alpha = \mathbf{42,87^\circ};$$

$$\frac{a}{\sin \alpha} = \frac{b}{\sin \beta} \Leftrightarrow \sin \beta = \frac{b \cdot \sin \alpha}{a} \Rightarrow \sin \beta = \frac{916 \text{ mm} \cdot \sin 42,87^\circ}{716 \text{ mm}} = 0,87 \Rightarrow \sin \beta \text{ (inv.)} = \beta = \mathbf{60,51^\circ};$$

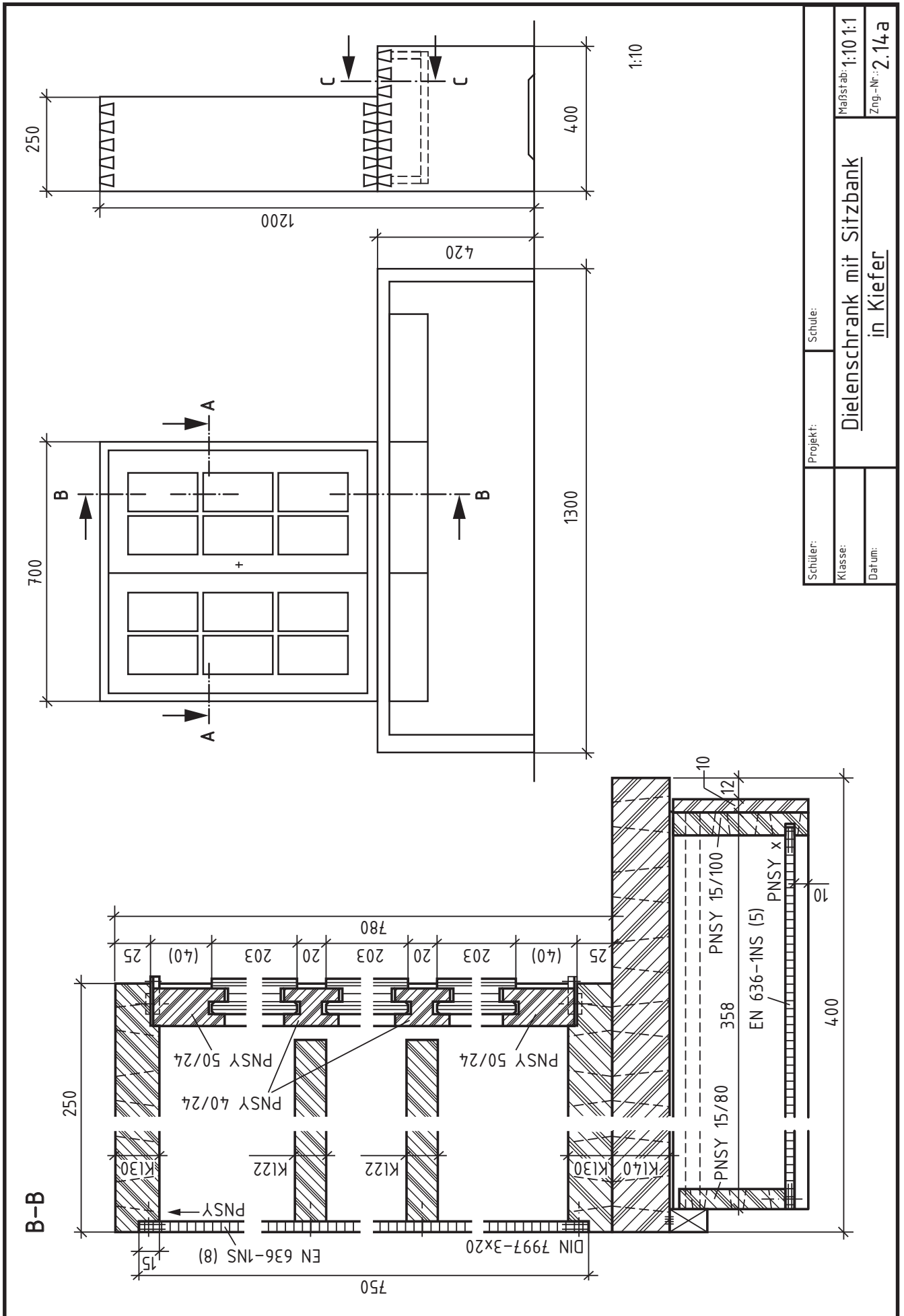
$$\gamma = 180^\circ - 42,87^\circ - 60,51^\circ = \mathbf{76,62^\circ}$$

$$2. \quad \sin \alpha = \frac{a}{c} \Leftrightarrow c = \frac{a}{\sin \alpha} \Rightarrow c = \frac{3,8 \text{ m}}{\sin 72^\circ} = 3,996 \text{ m}; \quad l_{\text{Leiter}} = 3,996 \text{ m} + 0,3 \text{ m} = \mathbf{4,296 \text{ m} \approx 4,3 \text{ m}}$$

$$3. \quad a = 708 \text{ mm}; \quad \alpha = 48,5^\circ; \beta = 84,2^\circ \Rightarrow \beta' = 180^\circ - 84,2^\circ = 95,8^\circ; \quad \gamma = 180^\circ - 48,5^\circ - 95,8^\circ = 35,7^\circ; \quad \gamma = 180^\circ - 48,5^\circ - 95,8^\circ - 35,7^\circ$$

$$\frac{a}{\sin \alpha} = \frac{c}{\sin \gamma}; \quad \text{angewendet:} \Rightarrow \frac{b'}{\sin \alpha} = \frac{a}{\sin \gamma} \Leftrightarrow b' = \frac{a \cdot \sin \alpha}{\sin \gamma} \Rightarrow \sin b' = \frac{708 \text{ mm} \cdot \sin 48,5^\circ}{\sin 35,7^\circ} = 908,69 \text{ mm};$$

$$\mathbf{Schnittbreite} = h; \quad \text{angewendet:} \Rightarrow \sin \beta = \frac{h}{b'} \Leftrightarrow h = \sin \beta \cdot b' \Rightarrow h = \sin 84,2^\circ \cdot 908,69 \text{ mm} = \mathbf{904,04 \text{ mm}}$$



Schüler:	Projekt:	Schule:	Maßstab: 1:10 1:1
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