Aufgabe 1.1

$$207^\circ\,42'\,9'' = \left(207 + \frac{42}{60} + \frac{9}{3600}\right)^\circ = 207.7025^\circ$$

Aufgabe 1.2

$$142.86^\circ = 142^\circ + 0.86 \cdot 3600'' = 142^\circ 3096'' = 142^\circ\,51'\,36''$$

Aufgabe 1.3

$$217^\circ = \frac{217^\circ \cdot 400^\mathrm{g}}{360^\circ} = 241.111^\mathrm{g}$$

Aufgabe 1.4

$$156^\mathrm{g} = \frac{156^\mathrm{g} \cdot 360^\circ}{400^\mathrm{g}} = 140.4^\circ$$

Aufgabe 1.5

$$245^\circ = \frac{245^\circ \cdot 2\pi\,\mathrm{rad}}{360^\circ} = 4.276\,\mathrm{rad}$$

Aufgabe 1.6

$$2.25\,\mathrm{rad} = \frac{2.25\,\mathrm{rad} \cdot 360^\circ}{2\pi\,\mathrm{rad}} = 128.916^\circ$$

Aufgabe 1.7

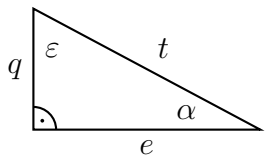
$$112^\mathrm{g} = \frac{112^\mathrm{g} \cdot 2\pi\,\mathrm{rad}}{400^\mathrm{g}} = 1.759\,\mathrm{rad}$$

Aufgabe 1.8

$$3.171\,\mathrm{rad} = \frac{3.171\,\mathrm{rad} \cdot 400^\mathrm{g}}{2\pi\,\mathrm{rad}} = 201.872^\mathrm{g}$$

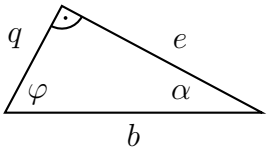
Aufgabe 2.1

Die Ankathete von α ist e.



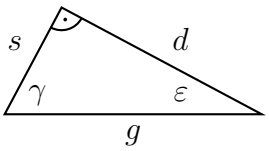
Aufgabe 2.2

Die Gegenkathete von α ist q.



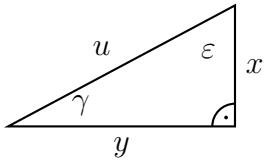
Aufgabe 2.3

Die Hypotenuse ist g. (unabhängig vom Winkel)



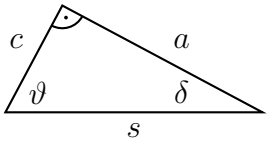
Aufgabe 2.4

$$\sin \varepsilon = \frac{y}{u}$$



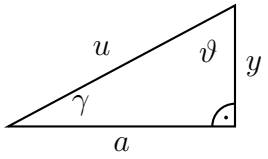
Aufgabe 2.5

$$\cos \vartheta = \frac{c}{s}$$



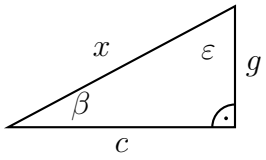
Aufgabe 2.6

$$\tan \vartheta = \frac{a}{y}$$



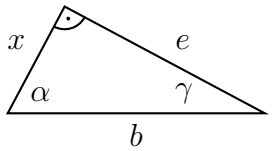
Aufgabe 2.7

$\frac{c}{x} = \sin\varepsilon = \cos\beta$



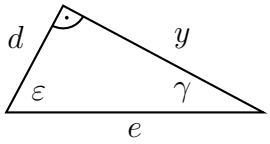
Aufgabe 2.8

$\frac{x}{b} = \cos\alpha = \sin\gamma$



Aufgabe 2.9

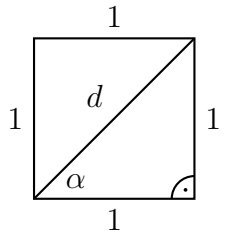
$\frac{d}{y} = \tan\gamma$



Aufgabe 2.10

$d = \sqrt{1^2 + 1^2} = \sqrt{2}$ $\alpha = 45°$

$\sin 45° = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$; $\cos 45° = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$; $\tan 45° = \frac{1}{1} = 1$



Aufgabe 2.11

$h = \sqrt{2^2 - 1^2} = \sqrt{3}$

$\alpha = 60°$: $\sin 60° = \frac{\sqrt{3}}{2}$; $\cos 60° = \frac{1}{2}$; $\tan 60° = \frac{\sqrt{3}}{1} = \sqrt{3}$

$\beta = 30°$: $\sin 30° = \frac{1}{2}$; $\cos 30° = \frac{\sqrt{3}}{2}$; $\tan 30° = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$

Aufgabe 2.12

(a) $\sin(52^\circ) = 0.788$

(b) $\cos(1.22\,\text{rad}) = 0.344$

(c) $\tan(79^\text{g}) = \tan\left(\dfrac{79^\text{g} \cdot 2\pi}{400^\text{g}}\right) = 2.921$

Aufgabe 2.13

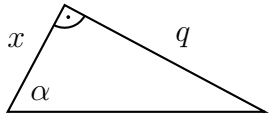
(a) $\arccos(0.26) = 74.93^\circ$

(b) $\arctan(7.4) = 1.436\,\text{rad}$

(c) $\arcsin(0.54) \cdot \dfrac{400^\text{g}}{2\pi} = 36.315^\text{g}$ (wenn der Rechner „im Bogenmass ist“)

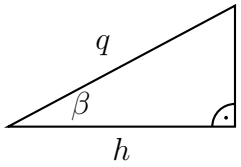
Aufgabe 2.14

$$\tan\alpha = \frac{q}{x} \quad \Rightarrow \quad x = \frac{q}{\tan\alpha} = \frac{q}{\tan\alpha^\circ} = 3.17$$



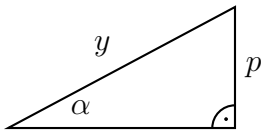
Aufgabe 2.15

$$\cos\beta = \frac{h}{q} \quad \Rightarrow \quad q = \frac{h}{\cos\beta^\circ} = \frac{3.3}{\cos 57^\circ} = 6.06$$



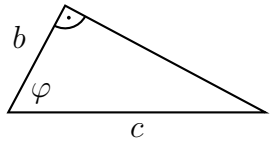
Aufgabe 2.16

$$\sin\alpha = \frac{p}{y} \quad \Rightarrow \quad y = \frac{p}{\sin\alpha} = \frac{8.1}{\sin 21^\circ} = 22.6$$



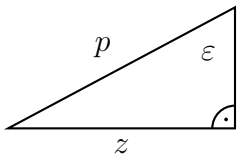
Aufgabe 2.17

$$\cos\varphi = \frac{b}{c} \quad \Rightarrow \quad \varphi = \arccos\frac{b}{c} = \arccos\frac{7.9}{10.4} = 40.57^\circ$$



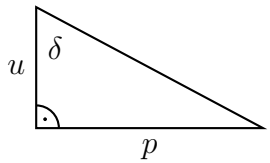
Aufgabe 2.18

$$\sin\varepsilon = \frac{z}{p} \quad \Rightarrow \quad \varepsilon = \arcsin\frac{z}{p} = \arcsin\frac{7.9}{11.5} = 43.39^\circ$$

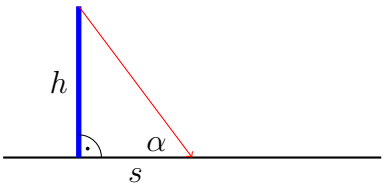


Aufgabe 2.19

$$\tan\delta = \frac{p}{u} \quad \Rightarrow \quad \delta = \arctan\frac{p}{u} = \arctan\frac{9.0}{6.6} = 53.75^\circ$$

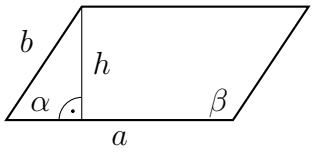


Aufgabe 3.1



$$\tan\alpha = \frac{h}{s} \quad \Rightarrow \quad h = s \cdot \tan\alpha = 19.0\,\mathrm{m} \cdot \tan(65^\circ) = 40.75\,\mathrm{m}$$

Aufgabe 3.2

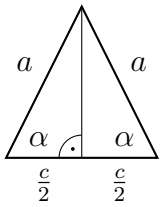


$\beta = 180° - \alpha = 180° - 33° = 147°$

$\sin\alpha = \dfrac{h}{b} \quad \Rightarrow \quad h = b \cdot \sin\alpha$

$A = a \cdot h = a \cdot b \cdot \sin\alpha = 6.4\,\text{cm} \cdot 4.8\,\text{cm} \cdot \sin(33°) = 16.7\,\text{cm}^2$

Aufgabe 3.3

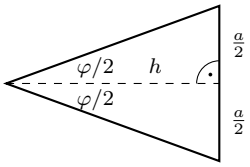


$\cos\alpha = \dfrac{c/2}{a} = \dfrac{c}{2a} \quad \Rightarrow \quad \alpha = \arccos\dfrac{c}{2a} = \arccos\dfrac{4.8}{12.8} = 67.98°$

$\gamma = 180° - 2\alpha = 44.04°$

Aufgabe 3.4

Ein regelmässiges 10-Eck besteht aus 10 gleichschenkligen Dreiecken.

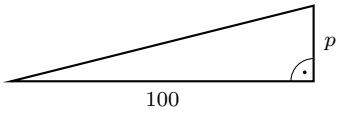


$\varphi = \dfrac{360°}{n} = \dfrac{360°}{10} = 36° \quad \Rightarrow \quad \dfrac{\varphi}{2} = 18°$

$\tan\dfrac{\varphi}{2} = \dfrac{a/2}{h} = \dfrac{a}{2h} \quad \Rightarrow \quad h = \dfrac{a}{2\tan(\varphi/2)}$

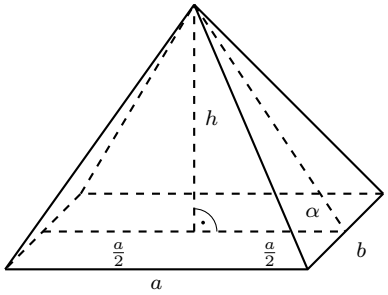
$A = n \cdot A_{\text{Dreieck}} = n \cdot h \cdot \dfrac{a}{2} = n \cdot \dfrac{a}{2\tan(\varphi/2)} \cdot \dfrac{a}{2} = \dfrac{n \cdot a^2}{4\tan(\varphi/2)} = \dfrac{10 \cdot 7.2^2}{4\tan(18°)} = 398.87\,\text{cm}^2$

Aufgabe 3.5

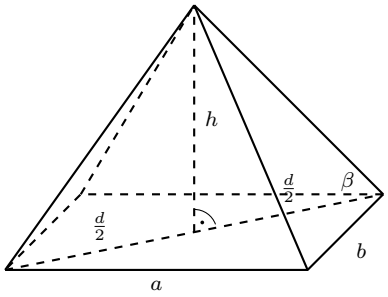


$\tan\varphi = \dfrac{p}{100} \quad \Rightarrow \quad \varphi = \arctan\dfrac{p}{100} = \arctan\dfrac{3}{100} = 1.72°$

Aufgabe 3.6



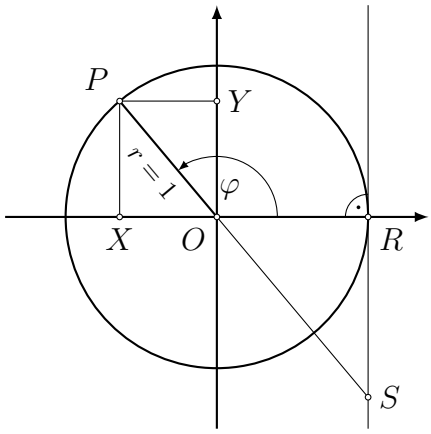
(a) $\tan\alpha = \dfrac{h}{a/2} = \dfrac{2h}{a} \quad \Rightarrow \quad \alpha = \arctan\dfrac{2h}{a} = \arctan\dfrac{6.2}{7.2} = 40.73°$



(b) $d = \sqrt{a^2+b^2} = \sqrt{7.2^2+2.1^2} = 7.5$

$\tan\beta = \dfrac{h}{d/2} = \dfrac{2h}{d} \quad \Rightarrow \quad \beta = \arctan\dfrac{2h}{d} = \arctan\dfrac{6.2}{7.5} = 39.58°$

Aufgabe 4.1



(a) $\overrightarrow{RS} = \tan\varphi$ (b) $\overrightarrow{OY} = \sin\varphi$ (c) $\overrightarrow{OX} = \cos\varphi$

Aufgabe 4.2

$\sin^2\varphi + \cos^2\varphi = 1 \quad \Rightarrow \quad \cos^2\varphi = 1 - \sin^2\varphi = 1 - \dfrac{3}{4} = \dfrac{1}{4} \quad \Rightarrow \quad \cos\varphi = \dfrac{1}{2}$

Aufgabe 4.3

$$\tan\varphi = \frac{\sin\varphi}{\cos\varphi} = \frac{2}{3} \quad \Rightarrow \quad \sin\varphi = \frac{2}{3}\cos\varphi \quad \Rightarrow \quad \sin^2\varphi = \frac{4}{9}\cos^2\varphi$$

$$\sin^2\varphi + \cos^2\varphi = 1 \quad \Rightarrow \quad \frac{4}{9}\cos^2\varphi + \cos^2\varphi = 1 \quad \Rightarrow \quad \frac{13}{9}\cos^2\varphi = 1$$

$$\cos^2\varphi = \frac{9}{13} \quad \Rightarrow \quad \cos\varphi = \frac{3\sqrt{13}}{13}$$

$$\sin^2\varphi = 1 - \cos^2\varphi = \frac{4}{13} \quad \Rightarrow \quad \sin\varphi = \frac{2\sqrt{13}}{13}$$

Aufgabe 4.4

(a) $\cos(0°) = 1$ (b) $\sin(0°) = 0$ (c) $\tan(180°) = 0$

Aufgabe 4.5

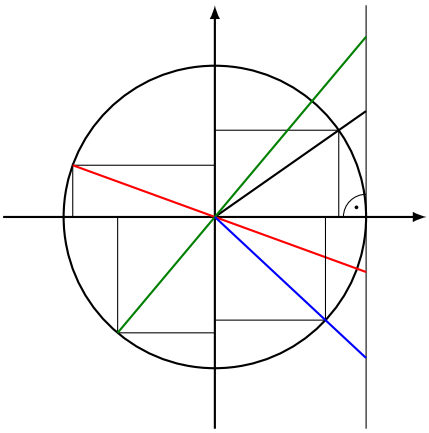
(a) $\sin(285°) < 0$ (b) $\tan(114°) < 0$ (c) $\cos(239°) < 0$

Aufgabe 4.6

(a) $\sin\varphi < 0$ und $\cos\varphi < 0$: III. Quadrant

(b) $\cos\varphi > 0$ und $\tan\varphi < 0$: IV. Quadrant

(c) $\sin\varphi > 0$ und $\tan\varphi < 0$: II. Quadrant



Aufgabe 4.7

(a) $\sin(-291°) = -\sin 291°$

(b) $\cos(-69°) = \cos 69°$

(c) $\tan(-220°) = -\tan 220°$

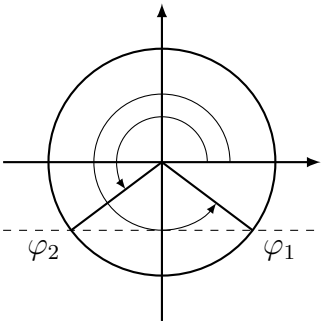
Aufgabe 4.8

(a) $\cos(121°) = -\sin(31°)$

(b) $\tan(204°) = -\cot(114°) = \tan(24°)$

(c) $\sin(308°) = \cos(218°) = -\sin(128°) = -\cos(38°)$

Aufgabe 4.9

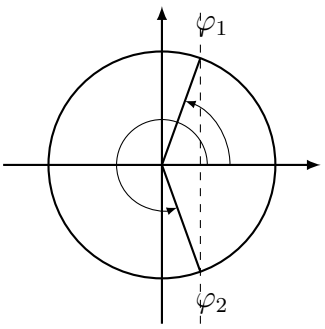


$\varphi = \arcsin(-0.601)° = -36.9°$

$\varphi_1 = \varphi + 360° = 323.1°$

$\varphi_2 = 180° - \varphi = 216.9°$

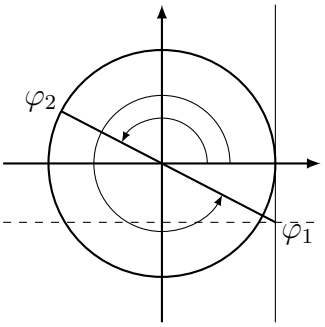
Aufgabe 4.10



$\varphi_1 = \arccos(0.339) = 70.2°$

$\varphi_2 = 360° - \varphi_1 = 289.8°$

Aufgabe 4.11



$\varphi = \arccos(-0.519)° = -27.4°$

$\varphi_1 = \varphi + 360° = 332.6°$

$\varphi_2 = \varphi + 180° = 152.6°$

Aufgabe 5.1

$x \to (x+2) \quad \Rightarrow \quad f_t\colon y = \cos(x+2)$

Aufgabe 5.2

$y \to (y+3) \quad \Rightarrow \quad f_t\colon y+3 = \tan(x) \quad \Rightarrow \quad f_t\colon y = \tan(x) - 3$

Aufgabe 5.3

$y \to -y \quad \Rightarrow \quad f_t\colon -y = \tan(x) \quad \Rightarrow \quad f_t\colon y = -\tan(x)$

Aufgabe 5.4

$x \to -x \quad \Rightarrow \quad f_t\colon y = \cos(-x) \quad \Rightarrow \quad f_t\colon y = \cos(x)$

Aufgabe 5.5

$x \to \frac{9}{5}x \quad \Rightarrow \quad f_t\colon y = \sin(\frac{9}{5}x)$

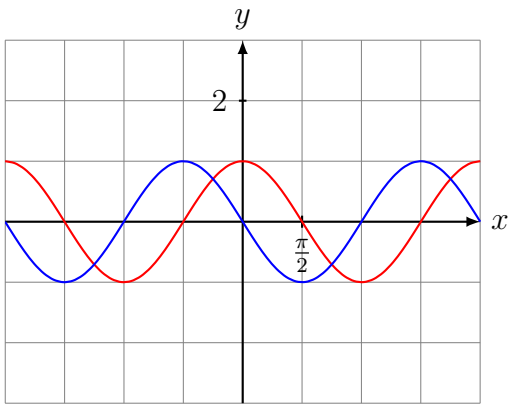
Aufgabe 5.6

$y \to \frac{2}{7}y \quad \Rightarrow \quad f_t\colon \frac{2}{7}y = \tan(x) \quad \Rightarrow \quad f_t\colon y = \frac{7}{2}\tan(x)$

Aufgabe 5.7

$f\colon y = \cos(x)$ (rot)

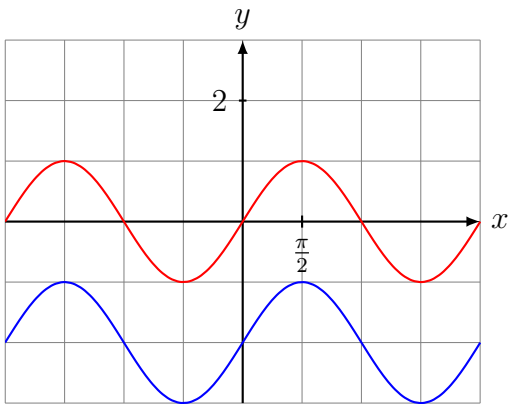
$g\colon y = \cos(x + \frac{\pi}{2})$ (blau)



Aufgabe 5.8

$f\colon y = \sin(x)$ (rot)

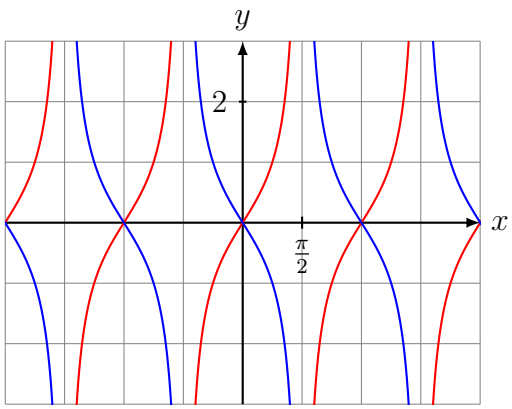
$f_t\colon y = \sin(x) - 2$ (blau)



Aufgabe 5.9

$f\colon y = \tan(x)$ (rot)

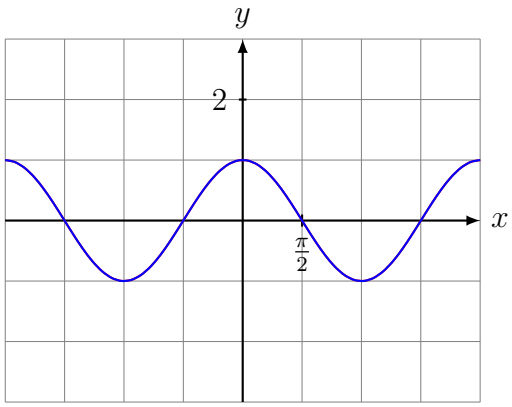
$g\colon y = -\tan(x)$ (blau)



Aufgabe 5.10

$f\colon y = \cos(x)$ (rot)

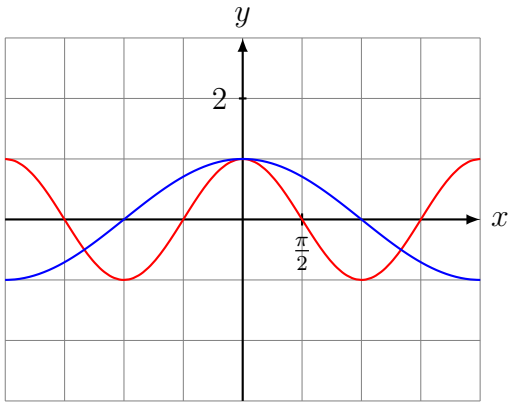
$g\colon y = \cos(-x)$ (blau)



Aufgabe 5.11

$f\colon y = \cos(x)$ (rot)

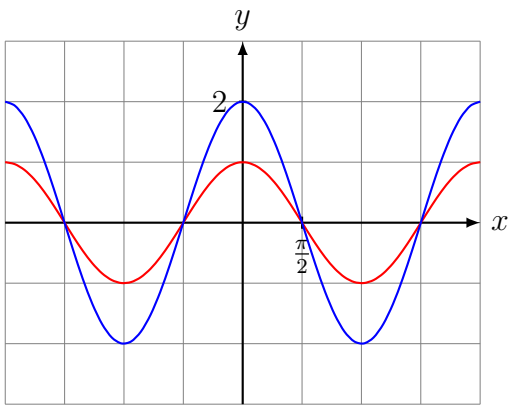
$f_t\colon y = \cos(\frac{1}{2}x)$ (blau)



Aufgabe 5.12

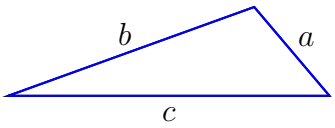
$f\colon y = \cos(x)$ (rot)

$g\colon y = 2\cos(x)$ (blau)



Aufgabe 6.1

Gegeben: $a = 3.08\,\text{cm}$, $b = 6.92\,\text{cm}$, $c = 8.5\,\text{cm}$

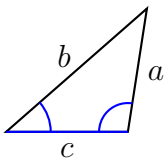


- Cosinussatz: $\alpha = \arccos\dfrac{b^2 + c^2 - a^2}{2bc} = 19.85°$
- Cosinussatz: $\beta = \arccos\dfrac{c^2 + a^2 - b^2}{2ca} = 49.72°$
- Cosinussatz: $\gamma = \arccos\dfrac{a^2 + b^2 - c^2}{2ab} = 110.43°$

Kontrolle: $\alpha + \beta + \gamma = 180.0°$

Aufgabe 6.2

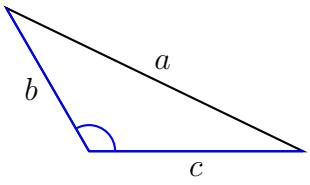
Gegeben: $c = 3.22\,\text{cm}$, $\alpha = 41.21°$, $\beta = 98.78°$



- Winkelsumme: $\gamma = 180° - \alpha - \beta = 40.01°$
- Sinussatz: $\dfrac{a}{\sin\alpha} = \dfrac{c}{\sin\gamma} \quad \Rightarrow \quad a = c \cdot \dfrac{\sin\alpha}{\sin\gamma} = 3.3\,\text{cm}$
- Sinussatz: $\dfrac{b}{\sin\beta} = \dfrac{c}{\sin\gamma} \quad \Rightarrow \quad b = c \cdot \dfrac{\sin\beta}{\sin\gamma} = 4.95\,\text{cm}$

Aufgabe 6.3

Gegeben: $b = 4.38\,\text{cm}$, $c = 5.66\,\text{cm}$, $\alpha = 120.04°$

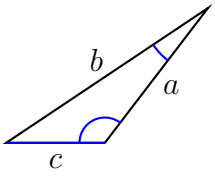


- Cosinussatz: $a = \sqrt{b^2 + c^2 - 2bc\cos\alpha} = 8.72\,\text{cm}$
- Cosinussatz: $\beta = \arccos\dfrac{c^2 + a^2 - b^2}{2ca} = 25.77°$
- Cosinussatz: $\gamma = \arccos\dfrac{a^2 + b^2 - c^2}{2ab} = 34.19°$

Kontrolle: $\alpha + \beta + \gamma = 180°$

Aufgabe 6.4

Gegeben: $c = 2.61\,\text{cm}$, $\beta = 127.43°$, $\gamma = 18.84°$



- Winkelsumme: $\alpha = 180° - \beta - \alpha = 33.73°$
- Sinussatz: $\dfrac{a}{\sin\alpha} = \dfrac{c}{\sin\gamma} \quad \Rightarrow \quad a = c \cdot \dfrac{\sin\alpha}{\sin\gamma} = 4.49\,\text{cm}$
- Sinussatz: $\dfrac{b}{\sin\beta} = \dfrac{c}{\sin\gamma} \quad \Rightarrow \quad b = c \cdot \dfrac{\sin\beta}{\sin\gamma} = 6.42\,\text{cm}$