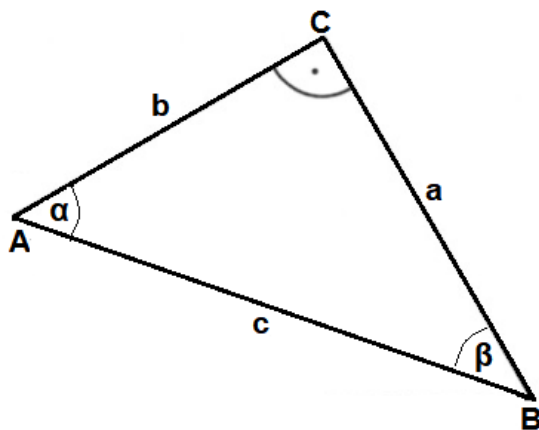


# Mathematik-Aufgabenpool

## > Trigonometrie IV (rechtwinklige Dreiecke)

**Einleitung:** In einem rechtwinkligen Dreieck  $\triangle ABC$  mit den Seiten  $a, b, c$  und den Winkeln  $\alpha, \beta, \gamma$  bei  $\gamma = 90^\circ$  heißen  $a$  und  $b$  Katheten,  $c$  Hypotenuse. Die Kathete, die gegenüber einem Winkel  $\alpha$  oder  $\beta$  liegt, heißt Gegenkathete (bei Winkel  $\alpha$  Seite  $a$ , bei Winkel  $\beta$  Seite  $b$ ), die Kathete, die an einem Winkel  $\alpha$  oder  $\beta$  liegt, heißt Ankathete (bei Winkel  $\alpha$  Seite  $b$ , bei Winkel  $\beta$  Seite  $a$ ).



Rechtwinkliges Dreieck: Seiten  $a, b, c$ ; Winkel  $\alpha, \beta, \gamma=90^\circ$

**Formelsammlung:**

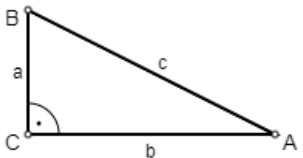
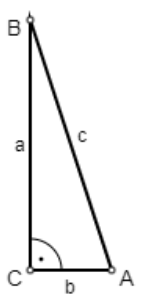
Satz des Pythagoras	$c^2 = a^2 + b^2 \Rightarrow c = \sqrt{a^2 + b^2}$ (Hypotenuse)		
	$a^2 = c^2 - b^2 \Rightarrow a = \sqrt{c^2 - b^2}$ (Kathete)		
	$b^2 = c^2 - a^2 \Rightarrow b = \sqrt{c^2 - a^2}$ (Kathete)		
Trigonometrische Beziehungen (Sinus, Kosinus, Tangens)	$\sin \alpha = \frac{a}{c} = \frac{\text{Gegenkathete}}{\text{Hypotenuse}}$	$\cos \alpha = \frac{b}{c} = \frac{\text{Ankathete}}{\text{Hypotenuse}}$	$\tan \alpha = \frac{a}{b} = \frac{\text{Gegenkathete}}{\text{Ankathete}}$
	$\sin \beta = \frac{b}{c} = \frac{\text{Gegenkathete}}{\text{Hypotenuse}}$	$\cos \beta = \frac{a}{c} = \frac{\text{Ankathete}}{\text{Hypotenuse}}$	$\tan \beta = \frac{b}{a} = \frac{\text{Gegenkathete}}{\text{Ankathete}}$
Winkel	$\alpha + \beta = 90^\circ$	$\alpha = 90^\circ - \beta$	$\beta = 90^\circ - \alpha$
Umfang	$u = a + b + c$		
Fläche	$A = \frac{1}{2} ab$		

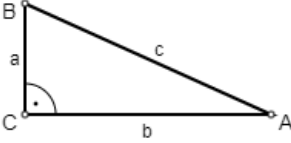
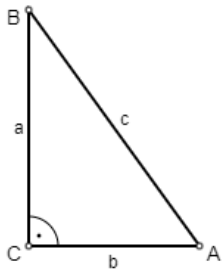
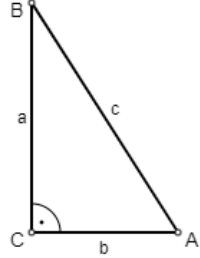
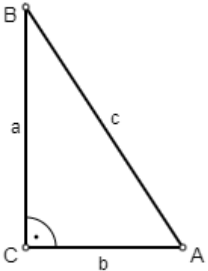
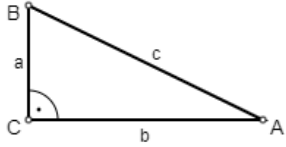
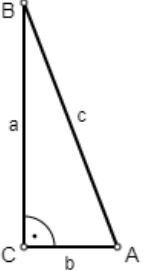
**Aufgabe 1:** Berechne die fehlenden Größen im rechtwinkligen Dreieck  $\triangle ABC$  (Winkel  $\gamma = 90^\circ$ ,  $a, b$  = Katheten,  $c$  = Hypotenuse, Winkel  $\alpha, \beta$ ).

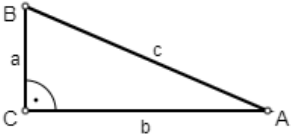
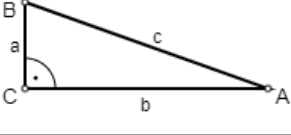
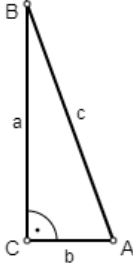
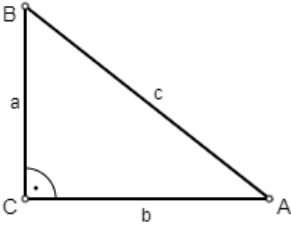
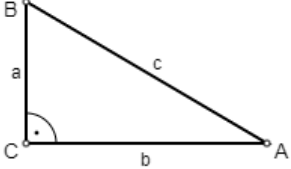
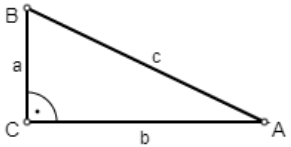
Nr.	Gegeben:	Gesucht:
1	$a = 1 \text{ cm}, b = 2 \text{ cm}$	$c, \alpha, \beta$
2	$a = 9.9 \text{ cm}, \alpha = 72.1^\circ$	$b, c, \beta$
3	$c = 7 \text{ cm}, \beta = 65.6^\circ$	$a, b, \alpha$
4	$c = 11.6 \text{ cm}, \beta = 35.9^\circ$	$a, b, \alpha$
5	$a = 7.4 \text{ cm}, c = 8.8 \text{ cm}$	$b, \alpha, \beta$
6	$a = 9.8 \text{ cm}, \beta = 33.1^\circ$	$b, c, \alpha$
7	$b = 3.9 \text{ cm}, c = 4.3 \text{ cm}$	$a, \alpha, \beta$
8	$b = 3.7 \text{ cm}, c = 10.4 \text{ cm}$	$a, \alpha, \beta$
9	$b = 5.3 \text{ cm}, \beta = 66.5^\circ$	$a, c, \alpha$
10	$a = 2 \text{ cm}, \beta = 70.3^\circ$	$b, c, \alpha$
11	$c = 8.5 \text{ cm}, \alpha = 70.1^\circ$	$a, c, \beta$
12	$a = 1.1 \text{ cm}, c = 1.8 \text{ cm}$	$b, \alpha, \beta$
13	$a = 2.4 \text{ cm}, \alpha = 30.3^\circ$	$b, c, \beta$
14	$b = 6 \text{ cm}, c = 6.7 \text{ cm}$	$a, \alpha, \beta$
15	$b = 3.4 \text{ cm}, \beta = 40.4^\circ$	$a, c, \alpha$
16	$a = 5.6 \text{ cm}, b = 7.1 \text{ cm}$	$c, \alpha, \beta$
17	$a = 8.4 \text{ cm}, \beta = 36.4^\circ$	$b, c, \alpha$
18	$a = 4.2 \text{ cm}, c = 8 \text{ cm}$	$b, \alpha, \beta$
19	$c = 7.2 \text{ cm}, \beta = 62^\circ$	$a, b, \alpha$
20	$c = 6.1 \text{ cm}, \beta = 45^\circ$	$a, b, \alpha$

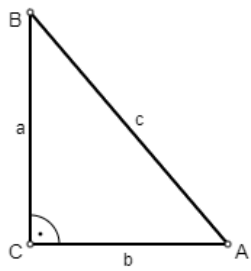
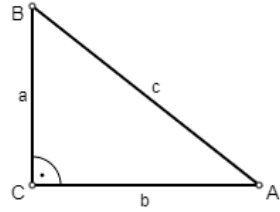
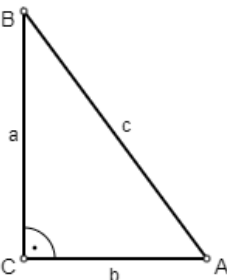
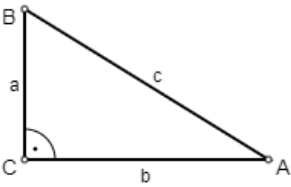
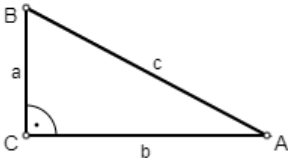
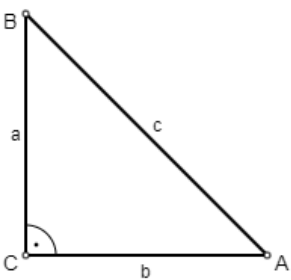
**Vorgehensweise:** Zur Ermittlung der fehlenden Größen beim rechtwinkligen Dreieck ist die obige Formelsammlung (trigonometrische Berechnungen) anzuwenden.

**Lösungen:**

Nr.	Gegeben:	Grafik:	Lösungen:
1	$a = 1 \text{ cm}, b = 2 \text{ cm}$		$\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 1/2 = 0.5 \rightarrow$ $\alpha = \tan^{-1}(0.5) = 26.6^\circ$  $\sin(\alpha) = a/c$ (Einsetzen) $\sin(26.6^\circ) = 1/c$ (Vertauschen $c \leftrightarrow \sin(26.6^\circ)$ ) $c = 1/\sin(26.6^\circ) = 2.2 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 26.6^\circ = 63.4^\circ$  $\rightarrow a = 1 \text{ cm}, b = 2 \text{ cm}, c = 2.2 \text{ cm}, \alpha = 26.6^\circ, \beta = 63.4^\circ$
2	$a = 9.9 \text{ cm}, \alpha = 72.1^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(72.1^\circ) = 9.9/c$ (Vertauschen $c \leftrightarrow \sin(72.1^\circ)$ ) $c = 9.9/\sin(72.1^\circ) = 10.4 \text{ cm}$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(72.1^\circ) = b/10.4 \mid \cdot 10.4$ $b = 10.4 \cdot \cos(72.1^\circ) = 3.2 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 72.1^\circ = 17.9^\circ$  $\rightarrow a = 9.9 \text{ cm}, b = 3.2 \text{ cm}, c = 10.4 \text{ cm}, \alpha = 72.1^\circ, \beta = 17.9^\circ$

3	$c = 7 \text{ cm}, \beta = 65.6^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(65.6^\circ) = b/7 \mid \cdot 7$ $b = 7 \cdot \sin(65.6^\circ) = 6.4 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(65.6^\circ) = a/7 \mid \cdot 7$ $a = 7 \cdot \cos(65.6^\circ) = 2.9 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 65.6^\circ = 24.4^\circ$  $\rightarrow a = 2.9 \text{ cm}, b = 6.4 \text{ cm}, c = 7 \text{ cm}, \alpha = 24.4^\circ, \beta = 65.6^\circ$
4	$c = 11.6 \text{ cm}, \beta = 35.9^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(35.9^\circ) = b/11.6 \mid \cdot 11.6$ $b = 11.6 \cdot \sin(35.9^\circ) = 6.8 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(35.9^\circ) = a/11.6 \mid \cdot 11.6$ $a = 11.6 \cdot \cos(35.9^\circ) = 9.4 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 35.9^\circ = 54.1^\circ$  $\rightarrow a = 9.4 \text{ cm}, b = 6.8 \text{ cm}, c = 11.6 \text{ cm}, \alpha = 54.1^\circ, \beta = 35.9^\circ$
5	$a = 7.4 \text{ cm}, c = 8.8 \text{ cm}$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(\alpha) = 7.4/8.8 = 0.8409 \rightarrow$ $\alpha = \sin^{-1}(0.8409) = 57.6^\circ$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(57.6^\circ) = b/8.8 \mid \cdot 8.8$ $b = 8.8 \cdot \cos(57.6^\circ) = 4.7 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 57.6^\circ = 32.4^\circ$  $\rightarrow a = 7.4 \text{ cm}, b = 4.7 \text{ cm}, c = 8.8 \text{ cm}, \alpha = 57.6^\circ, \beta = 32.4^\circ$
6	$a = 9.8 \text{ cm}, \beta = 33.1^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(33.1^\circ) = 9.8/c$ (Vertauschen $c \leftrightarrow \cos(33.1^\circ)$ ) $c = 9.8/\cos(33.1^\circ) = 11.7 \text{ cm}$  $\sin(\beta) = b/c$ (Einsetzen) $\sin(33.1^\circ) = b/11.7 \mid \cdot 11.7$ $b = 11.7 \cdot \sin(33.1^\circ) = 6.4 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 33.1^\circ = 56.9^\circ$  $\rightarrow a = 9.8 \text{ cm}, b = 6.4 \text{ cm}, c = 11.7 \text{ cm}, \alpha = 56.9^\circ, \beta = 33.1^\circ$
7	$b = 3.9 \text{ cm}, c = 4.3 \text{ cm}$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(\alpha) = 3.9/4.3 = 0.907 \rightarrow$ $\alpha = \cos^{-1}(0.907) = 26^\circ$  $\sin(\alpha) = a/c$ (Einsetzen) $\sin(26^\circ) = a/4.3 \mid \cdot 4.3$ $a = 4.3 \cdot \sin(26^\circ) = 3.9 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 26^\circ = 64^\circ$  $\rightarrow a = 3.9 \text{ cm}, b = 3.9 \text{ cm}, c = 4.3 \text{ cm}, \alpha = 26^\circ, \beta = 64^\circ$
8	$b = 3.7 \text{ cm}, c = 10.4 \text{ cm}$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(\alpha) = 3.7/10.4 = 0.3558 \rightarrow$ $\alpha = \cos^{-1}(0.3558) = 69.1^\circ$  $\sin(\alpha) = a/c$ (Einsetzen) $\sin(69.1^\circ) = a/10.4 \mid \cdot 10.4$ $a = 10.4 \cdot \sin(69.1^\circ) = 9.7 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 69.1^\circ = 20.9^\circ$  $\rightarrow a = 9.7 \text{ cm}, b = 3.7 \text{ cm}, c = 10.4 \text{ cm}, \alpha = 69.1^\circ, \beta = 20.9^\circ$

9	$b = 5.3 \text{ cm}, \beta = 66.5^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(66.5^\circ) = 5.3/c$ (Vertauschen $c \leftrightarrow \sin(66.5^\circ)$ ) $c = 5.3/\sin(66.5^\circ) = 5.8 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(66.5^\circ) = a/5.8 \mid \cdot 5.8$ $a = 5.8 \cdot \cos(66.5^\circ) = 2.3 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 66.5^\circ = 23.5^\circ$  $\rightarrow a = 2.3 \text{ cm}, b = 5.3 \text{ cm}, c = 5.8 \text{ cm}, \alpha = 23.5^\circ, \beta = 66.5^\circ$
10	$a = 2 \text{ cm}, \beta = 70.3^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(70.3^\circ) = 2/c$ (Vertauschen $c \leftrightarrow \cos(70.3^\circ)$ ) $c = 2/\cos(70.3^\circ) = 5.9 \text{ cm}$  $\sin(\beta) = b/c$ (Einsetzen) $\sin(70.3^\circ) = b/5.9 \mid \cdot 5.9$ $b = 5.9 \cdot \sin(70.3^\circ) = 5.6 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 70.3^\circ = 19.7^\circ$  $\rightarrow a = 2 \text{ cm}, b = 5.6 \text{ cm}, c = 5.9 \text{ cm}, \alpha = 19.7^\circ, \beta = 70.3^\circ$
11	$c = 8.5 \text{ cm}, \alpha = 70.1^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(70.1^\circ) = a/8.5 \mid \cdot 8.5$ $a = 8.5 \cdot \sin(70.1^\circ) = 8 \text{ cm}$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(70.1^\circ) = b/8.5 \mid \cdot 8.5$ $b = 8.5 \cdot \cos(70.1^\circ) = 2.9 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 70.1^\circ = 19.9^\circ$  $\rightarrow a = 8 \text{ cm}, b = 2.9 \text{ cm}, c = 8.5 \text{ cm}, \alpha = 70.1^\circ, \beta = 19.9^\circ$
12	$a = 1.1 \text{ cm}, c = 1.8 \text{ cm}$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(\alpha) = 1.1/1.8 = 0.6111 \rightarrow$ $\alpha = \sin^{-1}(0.6111) = 38.2^\circ$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(38.2^\circ) = b/1.8 \mid \cdot 1.8$ $b = 1.8 \cdot \cos(38.2^\circ) = 1.4 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 38.2^\circ = 51.8^\circ$  $\rightarrow a = 1.1 \text{ cm}, b = 1.4 \text{ cm}, c = 1.8 \text{ cm}, \alpha = 38.2^\circ, \beta = 51.8^\circ$
13	$a = 2.4 \text{ cm}, \alpha = 30.3^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(30.3^\circ) = 2.4/c$ (Vertauschen $c \leftrightarrow \sin(30.3^\circ)$ ) $c = 2.4/\sin(30.3^\circ) = 4.8 \text{ cm}$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(30.3^\circ) = b/4.8 \mid \cdot 4.8$ $b = 4.8 \cdot \cos(30.3^\circ) = 4.1 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 30.3^\circ = 59.7^\circ$  $\rightarrow a = 2.4 \text{ cm}, b = 4.1 \text{ cm}, c = 4.8 \text{ cm}, \alpha = 30.3^\circ, \beta = 59.7^\circ$
14	$b = 6 \text{ cm}, c = 6.7 \text{ cm}$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(\alpha) = 6/6.7 = 0.8955 \rightarrow$ $\alpha = \cos^{-1}(0.8955) = 25.8^\circ$  $\sin(\alpha) = a/c$ (Einsetzen) $\sin(25.8^\circ) = a/6.7 \mid \cdot 6.7$ $a = 6.7 \cdot \sin(25.8^\circ) = 6 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 25.8^\circ = 64.2^\circ$  $\rightarrow a = 6 \text{ cm}, b = 6 \text{ cm}, c = 6.7 \text{ cm}, \alpha = 25.8^\circ, \beta = 64.2^\circ$

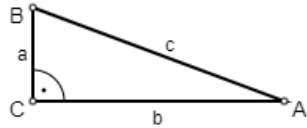
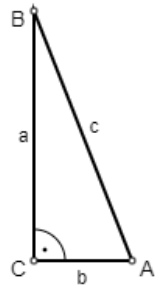
15	$b = 3.4 \text{ cm}, \beta = 40.4^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(40.4^\circ) = 3.4/c$ (Vertauschen $c \leftrightarrow \sin(40.4^\circ)$ ) $c = 3.4/\sin(40.4^\circ) = 5.2 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(40.4^\circ) = a/5.2 \mid \cdot 5.2$ $a = 5.2 \cdot \cos(40.4^\circ) = 4 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 40.4^\circ = 49.6^\circ$  $\rightarrow a = 4 \text{ cm}, b = 3.4 \text{ cm}, c = 5.2 \text{ cm}, \alpha = 49.6^\circ, \beta = 40.4^\circ$
16	$a = 5.6 \text{ cm}, b = 7.1 \text{ cm}$		$\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 5.6/7.1 = 0.7887 \rightarrow$ $\alpha = \tan^{-1}(0.7887) = 38.3^\circ$  $\sin(\alpha) = a/c$ (Einsetzen) $\sin(38.3^\circ) = 5.6/c$ (Vertauschen $c \leftrightarrow \sin(38.3^\circ)$ ) $c = 5.6/\sin(38.3^\circ) = 9 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 38.3^\circ = 51.7^\circ$  $\rightarrow a = 5.6 \text{ cm}, b = 7.1 \text{ cm}, c = 9 \text{ cm}, \alpha = 38.3^\circ, \beta = 51.7^\circ$
17	$a = 8.4 \text{ cm}, \beta = 36.4^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(36.4^\circ) = 8.4/c$ (Vertauschen $c \leftrightarrow \cos(36.4^\circ)$ ) $c = 8.4/\cos(36.4^\circ) = 10.4 \text{ cm}$  $\sin(\beta) = b/c$ (Einsetzen) $\sin(36.4^\circ) = b/10.4 \mid \cdot 10.4$ $b = 10.4 \cdot \sin(36.4^\circ) = 6.2 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 36.4^\circ = 53.6^\circ$  $\rightarrow a = 8.4 \text{ cm}, b = 6.2 \text{ cm}, c = 10.4 \text{ cm}, \alpha = 53.6^\circ, \beta = 36.4^\circ$
18	$a = 4.2 \text{ cm}, c = 8 \text{ cm}$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(\alpha) = 4.2/8 = 0.525 \rightarrow$ $\alpha = \sin^{-1}(0.525) = 31.7^\circ$  $\cos(\alpha) = b/c$ (Einsetzen) $\cos(31.7^\circ) = b/8 \mid \cdot 8$ $b = 8 \cdot \cos(31.7^\circ) = 6.8 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 31.7^\circ = 58.3^\circ$  $\rightarrow a = 4.2 \text{ cm}, b = 6.8 \text{ cm}, c = 8 \text{ cm}, \alpha = 31.7^\circ, \beta = 58.3^\circ$
19	$c = 7.2 \text{ cm}, \beta = 62^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(62^\circ) = b/7.2 \mid \cdot 7.2$ $b = 7.2 \cdot \sin(62^\circ) = 6.4 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(62^\circ) = a/7.2 \mid \cdot 7.2$ $a = 7.2 \cdot \cos(62^\circ) = 3.4 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 62^\circ = 28^\circ$  $\rightarrow a = 3.4 \text{ cm}, b = 6.4 \text{ cm}, c = 7.2 \text{ cm}, \alpha = 28^\circ, \beta = 62^\circ$
20	$c = 6.1 \text{ cm}, \beta = 45^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(45^\circ) = b/6.1 \mid \cdot 6.1$ $b = 6.1 \cdot \sin(45^\circ) = 4.3 \text{ cm}$  $\cos(\beta) = a/c$ (Einsetzen) $\cos(45^\circ) = a/6.1 \mid \cdot 6.1$ $a = 6.1 \cdot \cos(45^\circ) = 4.3 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 45^\circ = 45^\circ$  $\rightarrow a = 4.3 \text{ cm}, b = 4.3 \text{ cm}, c = 6.1 \text{ cm}, \alpha = 45^\circ, \beta = 45^\circ$

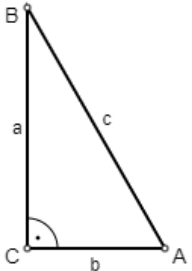
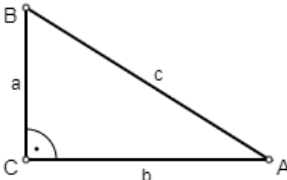
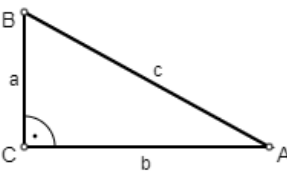
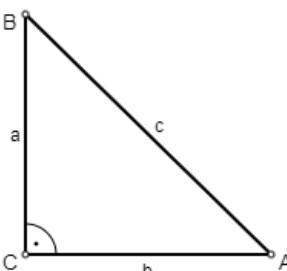
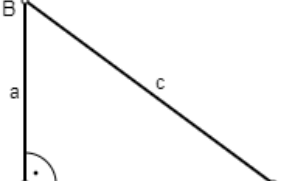
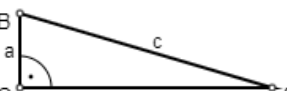
**Aufgabe 2:** Berechne die fehlenden Größen im rechtwinkligen Dreieck  $\triangle ABC$  (Winkel  $\gamma = 90^\circ$ ,  $a$ ,  $b$  = Katheten,  $c$  = Hypotenuse, Winkel  $\alpha$ ,  $\beta$ ).

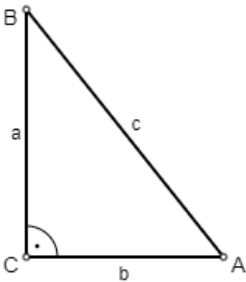
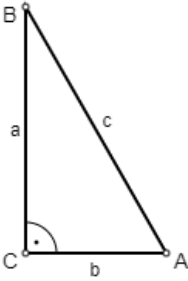
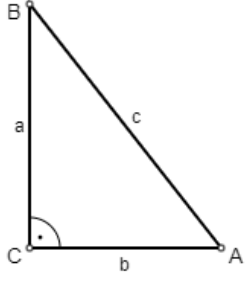
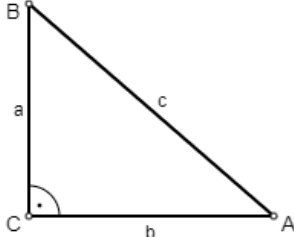
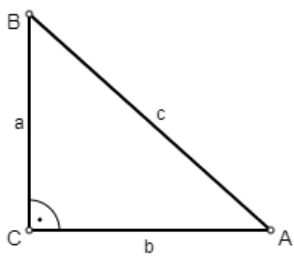
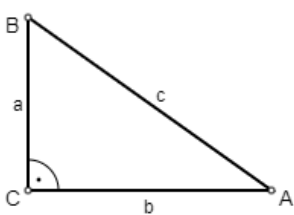
Nr.	Gegeben:	Gesucht:
1	$c = 25.9 \text{ cm}, \alpha = 20.6^\circ$	$a, b, \beta$
2	$b = 8.5 \text{ cm}, c = 23.1 \text{ cm}$	$a, \alpha, \beta$
3	$b = 13.6 \text{ cm}, \beta = 29.5^\circ$	$a, c, \alpha$
4	$a = 9.4 \text{ cm}, c = 17.7 \text{ cm}$	$b, \alpha, \beta$
5	$c = 17.8 \text{ cm}, \beta = 61.1^\circ$	$a, b, \alpha$
6	$c = 7.6 \text{ cm}, \beta = 45.5^\circ$	$a, b, \alpha$
7	$a = 11.6 \text{ cm}, b = 15.7 \text{ cm}$	$c, \alpha, \beta$
8	$a = 5.9 \text{ cm}, b = 20.1 \text{ cm}$	$c, \alpha, \beta$
9	$b = 6.6 \text{ cm}, \alpha = 51.5^\circ$	$a, c, \beta$
10	$b = 7.3 \text{ cm}, c = 14.8 \text{ cm}$	$a, \alpha, \beta$
11	$a = 14.3 \text{ cm}, b = 11.3 \text{ cm}$	$c, \alpha, \beta$
12	$a = 21.6 \text{ cm}, \alpha = 41.3^\circ$	$b, c, \beta$
13	$b = 20.5 \text{ cm}, c = 27.5 \text{ cm}$	$a, \alpha, \beta$
14	$a = 11.2 \text{ cm}, c = 19.4 \text{ cm}$	$b, \alpha, \beta$
15	$b = 22.2 \text{ cm}, \beta = 61.2^\circ$	$a, c, \alpha$
16	$a = 24 \text{ cm}, c = 32.7 \text{ cm}$	$b, \alpha, \beta$
17	$b = 21.9 \text{ cm}, \alpha = 44.2^\circ$	$a, c, \beta$
18	$a = 6.1 \text{ cm}, c = 9.9 \text{ cm}$	$b, \alpha, \beta$
19	$a = 6.9 \text{ cm}, \alpha = 23.7^\circ$	$b, c, \beta$
20	$a = 18.3 \text{ cm}, \alpha = 45.3^\circ$	$b, c, \beta$

**Vorgehensweise:** Zur Ermittlung der fehlenden Größen beim rechtwinkligen Dreieck ist die obige Formelsammlung (trigonometrische Berechnungen, Satz des Pythagoras) anzuwenden.

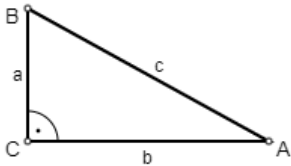
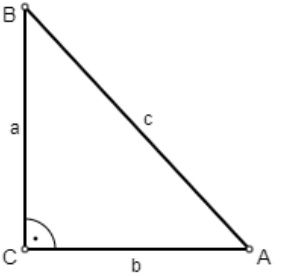
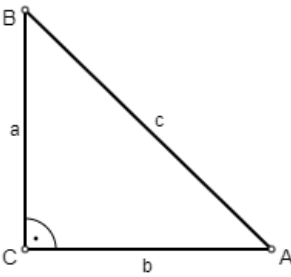
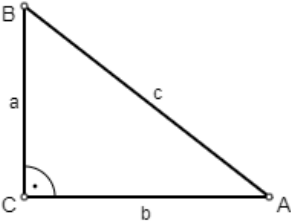
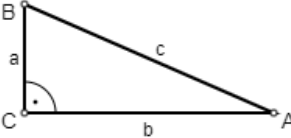
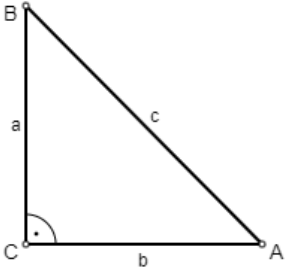
**Lösungen:**

Nr.	Gegeben:	Grafik:	Lösungen:
1	$c = 25.9 \text{ cm}, \alpha = 20.6^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(20.6^\circ) = a/25.9 \quad   \cdot 25.9$ $a = 25.9 \cdot \sin(20.6^\circ) = 9.1 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = \sqrt{25.9^2 - 9.1^2} = 585.64 \quad   \sqrt{\quad}$ $b = 24.2 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 20.6^\circ = 69.4^\circ$  $\rightarrow a = 9.1 \text{ cm}, b = 24.2 \text{ cm}, c = 25.9 \text{ cm}, \alpha = 20.6^\circ, \beta = 69.4^\circ$
2	$b = 8.5 \text{ cm}, c = 23.1 \text{ cm}$		$a^2 = c^2 - b^2$ (Einsetzen) $a = \sqrt{23.1^2 - 8.5^2} = 462.25 \quad   \sqrt{\quad}$ $a = 21.5 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 21.5/8.5 = 2.5294 \rightarrow$ $\alpha = \tan^{-1}(2.5294) = 68.4^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 68.4^\circ = 21.6^\circ$  $\rightarrow a = 21.5 \text{ cm}, b = 8.5 \text{ cm}, c = 23.1 \text{ cm}, \alpha = 68.4^\circ, \beta = 21.6^\circ$

3	$b = 13.6 \text{ cm}, \beta = 29.5^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(29.5^\circ) = 13.6/c$ (Vertauschen $c \leftrightarrow \sin(29.5^\circ)$ ) $c = 13.6/\sin(29.5^\circ) = 27.6 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 27.6^2 - 13.6^2 = 576 \mid \sqrt{\quad}$ $a = 24 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 29.5^\circ = 60.5^\circ$  $\rightarrow a = 24 \text{ cm}, b = 13.6 \text{ cm}, c = 27.6 \text{ cm}, \alpha = 60.5^\circ, \beta = 29.5^\circ$
4	$a = 9.4 \text{ cm}, c = 17.7 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 17.7^2 - 9.4^2 = 225 \mid \sqrt{\quad}$ $b = 15 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 9.4/15 = 0.6267 \rightarrow$ $\alpha = \tan^{-1}(0.6267) = 32.1^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 32.1^\circ = 57.9^\circ$  $\rightarrow a = 9.4 \text{ cm}, b = 15 \text{ cm}, c = 17.7 \text{ cm}, \alpha = 32.1^\circ, \beta = 57.9^\circ$
5	$c = 17.8 \text{ cm}, \beta = 61.1^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(61.1^\circ) = b/17.8 \mid \cdot 17.8$ $b = 17.8 \cdot \sin(61.1^\circ) = 15.6 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 17.8^2 - 15.6^2 = 73.96 \mid \sqrt{\quad}$ $a = 8.6 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 61.1^\circ = 28.9^\circ$  $\rightarrow a = 8.6 \text{ cm}, b = 15.6 \text{ cm}, c = 17.8 \text{ cm}, \alpha = 28.9^\circ, \beta = 61.1^\circ$
6	$c = 7.6 \text{ cm}, \beta = 45.5^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(45.5^\circ) = b/7.6 \mid \cdot 7.6$ $b = 7.6 \cdot \sin(45.5^\circ) = 5.4 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 7.6^2 - 5.4^2 = 28.09 \mid \sqrt{\quad}$ $a = 5.3 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 45.5^\circ = 44.5^\circ$  $\rightarrow a = 5.3 \text{ cm}, b = 5.4 \text{ cm}, c = 7.6 \text{ cm}, \alpha = 44.5^\circ, \beta = 45.5^\circ$
7	$a = 11.6 \text{ cm}, b = 15.7 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = 11.6^2 + 15.7^2 = 380.25 \mid \sqrt{\quad}$ $c = 19.5 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 11.6/15.7 = 0.7389 \rightarrow$ $\alpha = \tan^{-1}(0.7389) = 36.5^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 36.5^\circ = 53.5^\circ$  $\rightarrow a = 11.6 \text{ cm}, b = 15.7 \text{ cm}, c = 19.5 \text{ cm}, \alpha = 36.5^\circ, \beta = 53.5^\circ$
8	$a = 5.9 \text{ cm}, b = 20.1 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = 5.9^2 + 20.1^2 = 436.81 \mid \sqrt{\quad}$ $c = 20.9 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 5.9/20.1 = 0.2935 \rightarrow$ $\alpha = \tan^{-1}(0.2935) = 16.4^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 16.4^\circ = 73.6^\circ$  $\rightarrow a = 5.9 \text{ cm}, b = 20.1 \text{ cm}, c = 20.9 \text{ cm}, \alpha = 16.4^\circ, \beta = 73.6^\circ$

9	$b = 6.6 \text{ cm}, \alpha = 51.5^\circ$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(51.5^\circ) = 6.6/c$ (Vertauschen $c \leftrightarrow \cos(51.5^\circ)$ ) $c = 6.6/\cos(51.5^\circ) = 10.6 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 10.6^2 - 6.6^2 = 68.89 \mid \sqrt{\quad}$ $a = 8.3 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 51.5^\circ = 38.5^\circ$  $\rightarrow a = 8.3 \text{ cm}, b = 6.6 \text{ cm}, c = 10.6 \text{ cm}, \alpha = 51.5^\circ, \beta = 38.5^\circ$
10	$b = 7.3 \text{ cm}, c = 14.8 \text{ cm}$		$a^2 = c^2 - b^2$ (Einsetzen) $a = 14.8^2 - 7.3^2 = 166.41 \mid \sqrt{\quad}$ $a = 12.9 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 12.9/7.3 = 1.7671 \rightarrow$ $\alpha = \tan^{-1}(1.7671) = 60.5^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 60.5^\circ = 29.5^\circ$  $\rightarrow a = 12.9 \text{ cm}, b = 7.3 \text{ cm}, c = 14.8 \text{ cm}, \alpha = 60.5^\circ, \beta = 29.5^\circ$
11	$a = 14.3 \text{ cm}, b = 11.3 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = 14.3^2 + 11.3^2 = 331.24 \mid \sqrt{\quad}$ $c = 18.2 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 14.3/11.3 = 1.2655 \rightarrow$ $\alpha = \tan^{-1}(1.2655) = 51.7^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 51.7^\circ = 38.3^\circ$  $\rightarrow a = 14.3 \text{ cm}, b = 11.3 \text{ cm}, c = 18.2 \text{ cm}, \alpha = 51.7^\circ, \beta = 38.3^\circ$
12	$a = 21.6 \text{ cm}, \alpha = 41.3^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(41.3^\circ) = 21.6/c$ (Vertauschen $c \leftrightarrow \sin(41.3^\circ)$ ) $c = 21.6/\sin(41.3^\circ) = 32.7 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 32.7^2 - 21.6^2 = 605.16 \mid \sqrt{\quad}$ $b = 24.6 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 41.3^\circ = 48.7^\circ$  $\rightarrow a = 21.6 \text{ cm}, b = 24.6 \text{ cm}, c = 32.7 \text{ cm}, \alpha = 41.3^\circ, \beta = 48.7^\circ$
13	$b = 20.5 \text{ cm}, c = 27.5 \text{ cm}$		$a^2 = c^2 - b^2$ (Einsetzen) $a = 27.5^2 - 20.5^2 = 334.89 \mid \sqrt{\quad}$ $a = 18.3 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 18.3/20.5 = 0.8927 \rightarrow$ $\alpha = \tan^{-1}(0.8927) = 41.8^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 41.8^\circ = 48.2^\circ$  $\rightarrow a = 18.3 \text{ cm}, b = 20.5 \text{ cm}, c = 27.5 \text{ cm}, \alpha = 41.8^\circ, \beta = 48.2^\circ$
14	$a = 11.2 \text{ cm}, c = 19.4 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 19.4^2 - 11.2^2 = 249.64 \mid \sqrt{\quad}$ $b = 15.8 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 11.2/15.8 = 0.7089 \rightarrow$ $\alpha = \tan^{-1}(0.7089) = 35.3^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 35.3^\circ = 54.7^\circ$  $\rightarrow a = 11.2 \text{ cm}, b = 15.8 \text{ cm}, c = 19.4 \text{ cm}, \alpha = 35.3^\circ, \beta = 54.7^\circ$



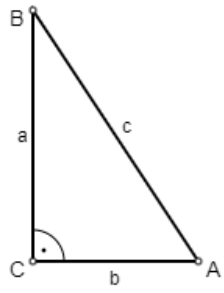
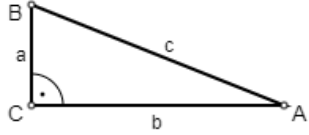
15	$b = 22.2 \text{ cm}, \beta = 61.2^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(61.2^\circ) = 22.2/c$ (Vertauschen $c \leftrightarrow \sin(61.2^\circ)$ ) $c = 22.2/\sin(61.2^\circ) = 25.3 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 25.3^2 - 22.2^2 = 148.84 \mid \sqrt{\quad}$ $a = 12.2 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 61.2^\circ = 28.8^\circ$  $\rightarrow a = 12.2 \text{ cm}, b = 22.2 \text{ cm}, c = 25.3 \text{ cm}, \alpha = 28.8^\circ, \beta = 61.2^\circ$
16	$a = 24 \text{ cm}, c = 32.7 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 32.7^2 - 24^2 = 492.84 \mid \sqrt{\quad}$ $b = 22.2 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 24/22.2 = 1.0811 \rightarrow$ $\alpha = \tan^{-1}(1.0811) = 47.2^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 47.2^\circ = 42.8^\circ$  $\rightarrow a = 24 \text{ cm}, b = 22.2 \text{ cm}, c = 32.7 \text{ cm}, \alpha = 47.2^\circ, \beta = 42.8^\circ$
17	$b = 21.9 \text{ cm}, \alpha = 44.2^\circ$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(44.2^\circ) = 21.9/c$ (Vertauschen $c \leftrightarrow \cos(44.2^\circ)$ ) $c = 21.9/\cos(44.2^\circ) = 30.5 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 30.5^2 - 21.9^2 = 453.69 \mid \sqrt{\quad}$ $a = 21.3 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 44.2^\circ = 45.8^\circ$  $\rightarrow a = 21.3 \text{ cm}, b = 21.9 \text{ cm}, c = 30.5 \text{ cm}, \alpha = 44.2^\circ, \beta = 45.8^\circ$
18	$a = 6.1 \text{ cm}, c = 9.9 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 9.9^2 - 6.1^2 = 60.84 \mid \sqrt{\quad}$ $b = 7.8 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 6.1/7.8 = 0.7821 \rightarrow$ $\alpha = \tan^{-1}(0.7821) = 38^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 38^\circ = 52^\circ$  $\rightarrow a = 6.1 \text{ cm}, b = 7.8 \text{ cm}, c = 9.9 \text{ cm}, \alpha = 38^\circ, \beta = 52^\circ$
19	$a = 6.9 \text{ cm}, \alpha = 23.7^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(23.7^\circ) = 6.9/c$ (Vertauschen $c \leftrightarrow \sin(23.7^\circ)$ ) $c = 6.9/\sin(23.7^\circ) = 17.1 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 17.1^2 - 6.9^2 = 246.49 \mid \sqrt{\quad}$ $b = 15.7 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 23.7^\circ = 66.3^\circ$  $\rightarrow a = 6.9 \text{ cm}, b = 15.7 \text{ cm}, c = 17.1 \text{ cm}, \alpha = 23.7^\circ, \beta = 66.3^\circ$
20	$a = 18.3 \text{ cm}, \alpha = 45.3^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(45.3^\circ) = 18.3/c$ (Vertauschen $c \leftrightarrow \sin(45.3^\circ)$ ) $c = 18.3/\sin(45.3^\circ) = 25.7 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 25.7^2 - 18.3^2 = 327.61 \mid \sqrt{\quad}$ $b = 18.1 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 45.3^\circ = 44.7^\circ$  $\rightarrow a = 18.3 \text{ cm}, b = 18.1 \text{ cm}, c = 25.7 \text{ cm}, \alpha = 45.3^\circ, \beta = 44.7^\circ$

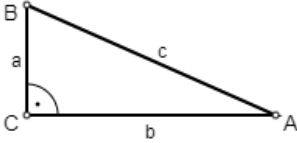
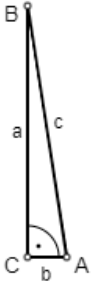
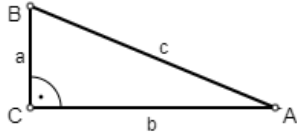
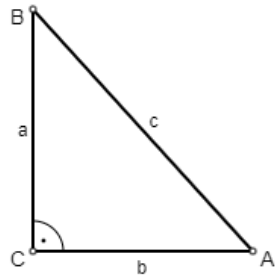
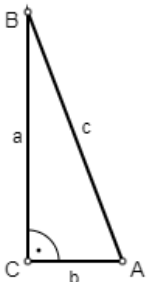
**Aufgabe 3:** Berechne die fehlenden Größen im rechtwinkligen Dreieck  $\triangle ABC$  (Winkel  $\gamma = 90^\circ$ ,  $a, b$  = Katheten,  $c$  = Hypotenuse, Winkel  $\alpha, \beta$ ,  $A$  = Flächeninhalt,  $u$  = Umfang).

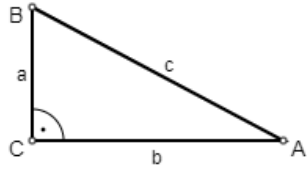
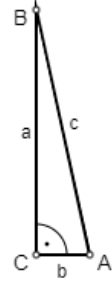
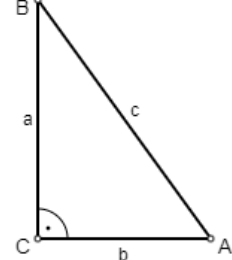
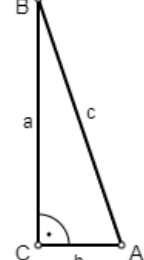
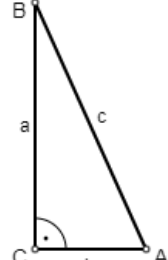
Nr.	Gegeben:	Gesucht:
1	$b = 17.9 \text{ cm}, c = 32.3 \text{ cm}$	$a, \alpha, \beta, A, u$
2	$a = 13.3 \text{ cm}, b = 33.3 \text{ cm}$	$c, \alpha, \beta, A, u$
3	$a = 17.2 \text{ cm}, c = 42.4 \text{ cm}$	$b, \alpha, \beta, A, u$
4	$a = 32.6 \text{ cm}, \alpha = 81.1^\circ$	$b, c, \beta, A, u$
5	$b = 38.3 \text{ cm}, c = 41.4 \text{ cm}$	$a, \alpha, \beta, A, u$
6	$a = 29 \text{ cm}, c = 39.1 \text{ cm}$	$b, \alpha, \beta, A, u$
7	$a = 28.8 \text{ cm}, \alpha = 69.1^\circ$	$b, c, \beta, A, u$
8	$a = 20.5 \text{ cm}, \beta = 61.9^\circ$	$b, c, \alpha, A, u$
9	$c = 28.2 \text{ cm}, \beta = 12.3^\circ$	$a, b, \alpha, A, u$
10	$a = 30.8 \text{ cm}, b = 22.3 \text{ cm}$	$c, \alpha, \beta, A, u$
11	$a = 28.9 \text{ cm}, c = 30.5 \text{ cm}$	$b, \alpha, \beta, A, u$
12	$b = 15.9 \text{ cm}, \beta = 24.2^\circ$	$a, c, \alpha, A, u$
13	$a = 8.4 \text{ cm}, \beta = 73^\circ$	$b, c, \alpha, A, u$
14	$a = 22.6 \text{ cm}, \beta = 35.5^\circ$	$b, c, \alpha, A, u$
15	$c = 41.9 \text{ cm}, \beta = 33.1^\circ$	$a, b, \alpha, A, u$
16	$a = 23.3 \text{ cm}, \alpha = 51.7^\circ$	$b, c, \beta, A, u$
17	$a = 24.5 \text{ cm}, c = 41.1 \text{ cm}$	$b, \alpha, \beta, A, u$
18	$b = 18.8 \text{ cm}, \alpha = 63^\circ$	$a, c, \beta, A, u$
19	$a = 14.1 \text{ cm}, b = 37.2 \text{ cm}$	$c, \alpha, \beta, A, u$
20	$a = 30 \text{ cm}, b = 27.3 \text{ cm}$	$c, \alpha, \beta, A, u$

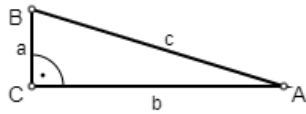



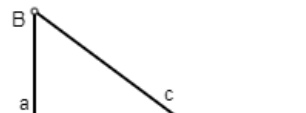
**Vorgehensweise:** Zur Ermittlung der fehlenden Größen beim rechtwinkligen Dreieck ist die obige Formelsammlung (trigonometrische Berechnungen, Satz des Pythagoras) anzuwenden.

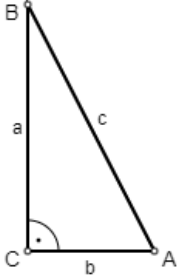
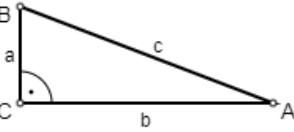
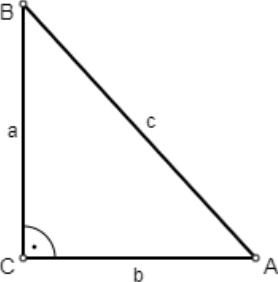
**Lösungen:**

Nr.	Gegeben:	Grafik:	Lösungen:
1	$b = 17.9 \text{ cm}, c = 32.3 \text{ cm}$		$a^2 = c^2 - b^2$ (Einsetzen) $a = \sqrt{32.3^2 - 17.9^2} = 26.9 \text{ cm}$ $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 26.9/17.9 = 1.5028 \rightarrow$ $\alpha = \tan^{-1}(1.5028) = 56.4^\circ$ $\beta = 90^\circ - \alpha = 90^\circ - 56.4^\circ = 33.6^\circ$ $A = ab/2 = 26.9 \cdot 17.9/2 = 240.8 \text{ cm}^2$ $u = a + b + c = 26.9 + 17.9 + 32.3 = 77.1 \text{ cm}$ $\rightarrow a = 26.9 \text{ cm}, b = 17.9 \text{ cm}, c = 32.3 \text{ cm}, \alpha = 56.4^\circ, \beta = 33.6^\circ,$ $A = 240.8 \text{ cm}^2, u = 77.1 \text{ cm}$
2	$a = 13.3 \text{ cm}, b = 33.3 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = \sqrt{13.3^2 + 33.3^2} = 35.9 \text{ cm}$ $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 13.3/33.3 = 0.3994 \rightarrow$ $\alpha = \tan^{-1}(0.3994) = 21.8^\circ$ $\beta = 90^\circ - \alpha = 90^\circ - 21.8^\circ = 68.2^\circ$ $A = ab/2 = 13.3 \cdot 33.3/2 = 221.4 \text{ cm}^2$

			$u = a + b + c = 13.3 + 33.3 + 35.9 = 82.5 \text{ cm}$ $\rightarrow a = 13.3 \text{ cm}, b = 33.3 \text{ cm}, c = 35.9 \text{ cm}, \alpha = 21.8^\circ, \beta = 68.2^\circ,$ $A = 221.4 \text{ cm}^2, u = 82.5 \text{ cm}$
3	$a = 17.2 \text{ cm}, c = 42.4 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 42.4^2 - 17.2^2 = 1505.44 \mid \sqrt{\quad}$ $b = 38.8 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 17.2/38.8 = 0.4433 \rightarrow$ $\alpha = \tan^{-1}(0.4433) = 23.9^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 23.9^\circ = 66.1^\circ$  $A = ab/2 = 17.2 \cdot 38.8 / 2 = 333.7 \text{ cm}^2$ $u = a + b + c = 17.2 + 38.8 + 42.4 = 98.4 \text{ cm}$  $\rightarrow a = 17.2 \text{ cm}, b = 38.8 \text{ cm}, c = 42.4 \text{ cm}, \alpha = 23.9^\circ, \beta = 66.1^\circ,$ $A = 333.7 \text{ cm}^2, u = 98.4 \text{ cm}$
4	$a = 32.6 \text{ cm}, \alpha = 81.1^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(81.1^\circ) = 32.6/c$ (Vertauschen $c \leftrightarrow \sin(81.1^\circ)$ ) $c = 32.6/\sin(81.1^\circ) = 33 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 33^2 - 32.6^2 = 26.01 \mid \sqrt{\quad}$ $b = 5.1 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 81.1^\circ = 8.9^\circ$  $A = ab/2 = 32.6 \cdot 5.1 / 2 = 83.1 \text{ cm}^2$ $u = a + b + c = 32.6 + 5.1 + 33 = 70.7 \text{ cm}$  $\rightarrow a = 32.6 \text{ cm}, b = 5.1 \text{ cm}, c = 33 \text{ cm}, \alpha = 81.1^\circ, \beta = 8.9^\circ,$ $A = 83.1 \text{ cm}^2, u = 70.7 \text{ cm}$
5	$b = 38.3 \text{ cm}, c = 41.4 \text{ cm}$		$a^2 = c^2 - b^2$ (Einsetzen) $a = 41.4^2 - 38.3^2 = 246.49 \mid \sqrt{\quad}$ $a = 15.7 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 15.7/38.3 = 0.4099 \rightarrow$ $\alpha = \tan^{-1}(0.4099) = 22.3^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 22.3^\circ = 67.7^\circ$  $A = ab/2 = 15.7 \cdot 38.3 / 2 = 300.7 \text{ cm}^2$ $u = a + b + c = 15.7 + 38.3 + 41.4 = 95.4 \text{ cm}$  $\rightarrow a = 15.7 \text{ cm}, b = 38.3 \text{ cm}, c = 41.4 \text{ cm}, \alpha = 22.3^\circ, \beta = 67.7^\circ,$ $A = 300.7 \text{ cm}^2, u = 95.4 \text{ cm}$
6	$a = 29 \text{ cm}, c = 39.1 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 39.1^2 - 29^2 = 691.69 \mid \sqrt{\quad}$ $b = 26.3 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 29/26.3 = 1.1027 \rightarrow$ $\alpha = \tan^{-1}(1.1027) = 47.8^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 47.8^\circ = 42.2^\circ$  $A = ab/2 = 29 \cdot 26.3 / 2 = 381.4 \text{ cm}^2$ $u = a + b + c = 29 + 26.3 + 39.1 = 94.4 \text{ cm}$  $\rightarrow a = 29 \text{ cm}, b = 26.3 \text{ cm}, c = 39.1 \text{ cm}, \alpha = 47.8^\circ, \beta = 42.2^\circ,$ $A = 381.4 \text{ cm}^2, u = 94.4 \text{ cm}$
7	$a = 28.8 \text{ cm}, \alpha = 69.1^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(69.1^\circ) = 28.8/c$ (Vertauschen $c \leftrightarrow \sin(69.1^\circ)$ ) $c = 28.8/\sin(69.1^\circ) = 30.8 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 30.8^2 - 28.8^2 = 121 \mid \sqrt{\quad}$ $b = 11 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 69.1^\circ = 20.9^\circ$  $A = ab/2 = 28.8 \cdot 11 / 2 = 158.4 \text{ cm}^2$ $u = a + b + c = 28.8 + 11 + 30.8 = 70.6 \text{ cm}$

			-> a = 28.8 cm, b = 11 cm, c = 30.8 cm, $\alpha = 69.1^\circ$ , $\beta = 20.9^\circ$ , A = 158.4 cm <sup>2</sup> , u = 70.6 cm
8	a = 20.5 cm, $\beta = 61.9^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(61.9^\circ) = 20.5/c$ (Vertauschen c $\leftrightarrow$ $\cos(61.9^\circ)$ ) $c = 20.5/\cos(61.9^\circ) = 43.5$ cm  $b^2 = c^2 - a^2$ (Einsetzen) $b = \sqrt{43.5^2 - 20.5^2} = 1474.56 \mid \sqrt{\quad}$ $b = 38.4$ cm  $\alpha = 90^\circ - \beta = 90^\circ - 61.9^\circ = 28.1^\circ$  $A = ab/2 = 20.5 \cdot 38.4/2 = 393.6$ cm <sup>2</sup> $u = a + b + c = 20.5 + 38.4 + 43.5 = 102.4$ cm  -> a = 20.5 cm, b = 38.4 cm, c = 43.5 cm, $\alpha = 28.1^\circ$ , $\beta = 61.9^\circ$ , A = 393.6 cm <sup>2</sup> , u = 102.4 cm
9	c = 28.2 cm, $\beta = 12.3^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(12.3^\circ) = b/28.2 \mid \cdot 28.2$ $b = 28.2 \cdot \sin(12.3^\circ) = 6$ cm  $a^2 = c^2 - b^2$ (Einsetzen) $a = \sqrt{28.2^2 - 6^2} = 761.76 \mid \sqrt{\quad}$ $a = 27.6$ cm  $\alpha = 90^\circ - \beta = 90^\circ - 12.3^\circ = 77.7^\circ$  $A = ab/2 = 27.6 \cdot 6/2 = 82.8$ cm <sup>2</sup> $u = a + b + c = 27.6 + 6 + 28.2 = 61.8$ cm  -> a = 27.6 cm, b = 6 cm, c = 28.2 cm, $\alpha = 77.7^\circ$ , $\beta = 12.3^\circ$ , A = 82.8 cm <sup>2</sup> , u = 61.8 cm
10	a = 30.8 cm, b = 22.3 cm		$c^2 = a^2 + b^2$ (Einsetzen) $c = \sqrt{30.8^2 + 22.3^2} = 1444 \mid \sqrt{\quad}$ $c = 38$ cm  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 30.8/22.3 = 1.3812 \rightarrow$ $\alpha = \tan^{-1}(1.3812) = 54.1^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 54.1^\circ = 35.9^\circ$  $A = ab/2 = 30.8 \cdot 22.3/2 = 343.4$ cm <sup>2</sup> $u = a + b + c = 30.8 + 22.3 + 38 = 91.1$ cm  -> a = 30.8 cm, b = 22.3 cm, c = 38 cm, $\alpha = 54.1^\circ$ , $\beta = 35.9^\circ$ , A = 343.4 cm <sup>2</sup> , u = 91.1 cm
11	a = 28.9 cm, c = 30.5 cm		$b^2 = c^2 - a^2$ (Einsetzen) $b = \sqrt{30.5^2 - 28.9^2} = 94.09 \mid \sqrt{\quad}$ $b = 9.7$ cm  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 28.9/9.7 = 2.9794 \rightarrow$ $\alpha = \tan^{-1}(2.9794) = 71.4^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 71.4^\circ = 18.6^\circ$  $A = ab/2 = 28.9 \cdot 9.7/2 = 140.2$ cm <sup>2</sup> $u = a + b + c = 28.9 + 9.7 + 30.5 = 69.1$ cm  -> a = 28.9 cm, b = 9.7 cm, c = 30.5 cm, $\alpha = 71.4^\circ$ , $\beta = 18.6^\circ$ , A = 140.2 cm <sup>2</sup> , u = 69.1 cm
12	b = 15.9 cm, $\beta = 24.2^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(24.2^\circ) = 15.9/c$ (Vertauschen c $\leftrightarrow$ $\sin(24.2^\circ)$ ) $c = 15.9/\sin(24.2^\circ) = 38.8$ cm  $a^2 = c^2 - b^2$ (Einsetzen) $a = \sqrt{38.8^2 - 15.9^2} = 1253.16 \mid \sqrt{\quad}$ $a = 35.4$ cm  $\alpha = 90^\circ - \beta = 90^\circ - 24.2^\circ = 65.8^\circ$  $A = ab/2 = 35.4 \cdot 15.9/2 = 281.4$ cm <sup>2</sup> $u = a + b + c = 35.4 + 15.9 + 38.8 = 90.1$ cm  -> a = 35.4 cm, b = 15.9 cm, c = 38.8 cm, $\alpha = 65.8^\circ$ , $\beta = 24.2^\circ$ , A = 281.4 cm <sup>2</sup> , u = 90.1 cm

13	$a = 8.4 \text{ cm}, \beta = 73^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(73^\circ) = 8.4/c$ (Vertauschen $c \leftrightarrow \cos(73^\circ)$ ) $c = 8.4/\cos(73^\circ) = 28.7 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 28.7^2 - 8.4^2 = 750.76 \mid \sqrt{\quad}$ $b = 27.4 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 73^\circ = 17^\circ$  $A = ab/2 = 8.4 \cdot 27.4/2 = 115.1 \text{ cm}^2$ $u = a + b + c = 8.4 + 27.4 + 28.7 = 64.5 \text{ cm}$  $\rightarrow a = 8.4 \text{ cm}, b = 27.4 \text{ cm}, c = 28.7 \text{ cm}, \alpha = 17^\circ, \beta = 73^\circ,$ $A = 115.1 \text{ cm}^2, u = 64.5 \text{ cm}$
14	$a = 22.6 \text{ cm}, \beta = 35.5^\circ$		$\cos(\beta) = a/c$ (Einsetzen) $\cos(35.5^\circ) = 22.6/c$ (Vertauschen $c \leftrightarrow \cos(35.5^\circ)$ ) $c = 22.6/\cos(35.5^\circ) = 27.7 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 27.7^2 - 22.6^2 = 259.21 \mid \sqrt{\quad}$ $b = 16.1 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 35.5^\circ = 54.5^\circ$  $A = ab/2 = 22.6 \cdot 16.1/2 = 181.9 \text{ cm}^2$ $u = a + b + c = 22.6 + 16.1 + 27.7 = 66.4 \text{ cm}$  $\rightarrow a = 22.6 \text{ cm}, b = 16.1 \text{ cm}, c = 27.7 \text{ cm}, \alpha = 54.5^\circ, \beta = 35.5^\circ,$ $A = 181.9 \text{ cm}^2, u = 66.4 \text{ cm}$
15	$c = 41.9 \text{ cm}, \beta = 33.1^\circ$		$\sin(\beta) = b/c$ (Einsetzen) $\sin(33.1^\circ) = b/41.9 \mid \cdot 41.9$ $b = 41.9 \cdot \sin(33.1^\circ) = 22.9 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 41.9^2 - 22.9^2 = 1232.01 \mid \sqrt{\quad}$ $a = 35.1 \text{ cm}$  $\alpha = 90^\circ - \beta = 90^\circ - 33.1^\circ = 56.9^\circ$  $A = ab/2 = 35.1 \cdot 22.9/2 = 401.9 \text{ cm}^2$ $u = a + b + c = 35.1 + 22.9 + 41.9 = 99.9 \text{ cm}$  $\rightarrow a = 35.1 \text{ cm}, b = 22.9 \text{ cm}, c = 41.9 \text{ cm}, \alpha = 56.9^\circ, \beta = 33.1^\circ,$ $A = 401.9 \text{ cm}^2, u = 99.9 \text{ cm}$
16	$a = 23.3 \text{ cm}, \alpha = 51.7^\circ$		$\sin(\alpha) = a/c$ (Einsetzen) $\sin(51.7^\circ) = 23.3/c$ (Vertauschen $c \leftrightarrow \sin(51.7^\circ)$ ) $c = 23.3/\sin(51.7^\circ) = 29.7 \text{ cm}$  $b^2 = c^2 - a^2$ (Einsetzen) $b = 29.7^2 - 23.3^2 = 338.56 \mid \sqrt{\quad}$ $b = 18.4 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 51.7^\circ = 38.3^\circ$  $A = ab/2 = 23.3 \cdot 18.4/2 = 214.4 \text{ cm}^2$ $u = a + b + c = 23.3 + 18.4 + 29.7 = 71.4 \text{ cm}$  $\rightarrow a = 23.3 \text{ cm}, b = 18.4 \text{ cm}, c = 29.7 \text{ cm}, \alpha = 51.7^\circ, \beta = 38.3^\circ,$ $A = 214.4 \text{ cm}^2, u = 71.4 \text{ cm}$
17	$a = 24.5 \text{ cm}, c = 41.1 \text{ cm}$		$b^2 = c^2 - a^2$ (Einsetzen) $b = 41.1^2 - 24.5^2 = 1089 \mid \sqrt{\quad}$ $b = 33 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 24.5/33 = 0.7424 \rightarrow$ $\alpha = \tan^{-1}(0.7424) = 36.6^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 36.6^\circ = 53.4^\circ$  $A = ab/2 = 24.5 \cdot 33/2 = 404.3 \text{ cm}^2$ $u = a + b + c = 24.5 + 33 + 41.1 = 98.6 \text{ cm}$  $\rightarrow a = 24.5 \text{ cm}, b = 33 \text{ cm}, c = 41.1 \text{ cm}, \alpha = 36.6^\circ, \beta = 53.4^\circ,$ $A = 404.3 \text{ cm}^2, u = 98.6 \text{ cm}$

18	$b = 18.8 \text{ cm}, \alpha = 63^\circ$		$\cos(\alpha) = b/c$ (Einsetzen) $\cos(63^\circ) = 18.8/c$ (Vertauschen $c \leftrightarrow \cos(63^\circ)$ ) $c = 18.8/\cos(63^\circ) = 41.4 \text{ cm}$  $a^2 = c^2 - b^2$ (Einsetzen) $a = 41.4^2 - 18.8^2 = 1361.61 \mid \sqrt{\quad}$ $a = 36.9 \text{ cm}$  $\beta = 90^\circ - \alpha = 90^\circ - 63^\circ = 27^\circ$  $A = ab/2 = 36.9 \cdot 18.8/2 = 346.9 \text{ cm}^2$ $u = a + b + c = 36.9 + 18.8 + 41.4 = 97.1 \text{ cm}$  $\rightarrow a = 36.9 \text{ cm}, b = 18.8 \text{ cm}, c = 41.4 \text{ cm}, \alpha = 63^\circ, \beta = 27^\circ,$ $A = 346.9 \text{ cm}^2, u = 97.1 \text{ cm}$
19	$a = 14.1 \text{ cm}, b = 37.2 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = 14.1^2 + 37.2^2 = 1584.04 \mid \sqrt{\quad}$ $c = 39.8 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 14.1/37.2 = 0.379 \rightarrow$ $\alpha = \tan^{-1}(0.379) = 20.8^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 20.8^\circ = 69.2^\circ$  $A = ab/2 = 14.1 \cdot 37.2/2 = 262.3 \text{ cm}^2$ $u = a + b + c = 14.1 + 37.2 + 39.8 = 91.1 \text{ cm}$  $\rightarrow a = 14.1 \text{ cm}, b = 37.2 \text{ cm}, c = 39.8 \text{ cm}, \alpha = 20.8^\circ, \beta = 69.2^\circ,$ $A = 262.3 \text{ cm}^2, u = 91.1 \text{ cm}$
20	$a = 30 \text{ cm}, b = 27.3 \text{ cm}$		$c^2 = a^2 + b^2$ (Einsetzen) $c = 30^2 + 27.3^2 = 1648.36 \mid \sqrt{\quad}$ $c = 40.6 \text{ cm}$  $\tan(\alpha) = a/b$ (Einsetzen) $\tan(\alpha) = 30/27.3 = 1.0989 \rightarrow$ $\alpha = \tan^{-1}(1.0989) = 47.7^\circ$  $\beta = 90^\circ - \alpha = 90^\circ - 47.7^\circ = 42.3^\circ$  $A = ab/2 = 30 \cdot 27.3/2 = 409.5 \text{ cm}^2$ $u = a + b + c = 30 + 27.3 + 40.6 = 97.9 \text{ cm}$  $\rightarrow a = 30 \text{ cm}, b = 27.3 \text{ cm}, c = 40.6 \text{ cm}, \alpha = 47.7^\circ, \beta = 42.3^\circ,$ $A = 409.5 \text{ cm}^2, u = 97.9 \text{ cm}$