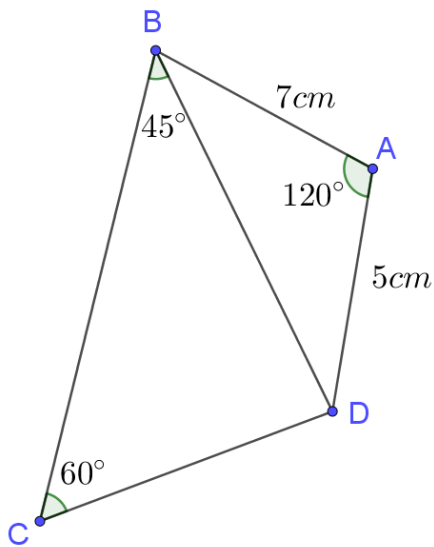


The following diagram shows a quadrilateral ABCD.



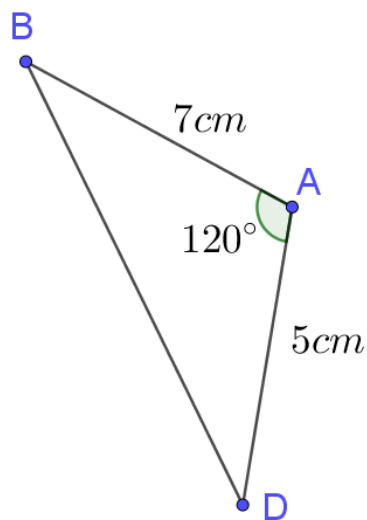
$AB = 7\text{ cm}$, $AD = 5\text{ cm}$, $\angle DAB = 120^\circ$, $\angle DBC = 45^\circ$, $\angle BCD = 60^\circ$

$$BD = \sqrt{a}$$

$$CD = \sqrt{b}$$

Where $a, b \in \mathbb{Q}$

Find a and b



Use the cosine rule:

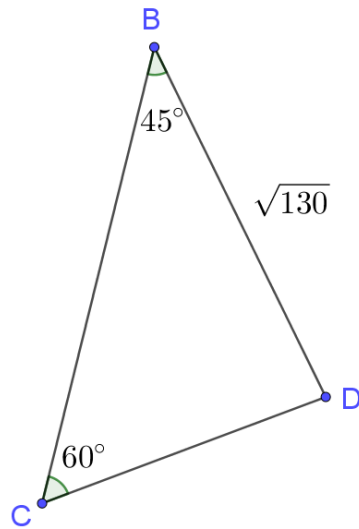
$$BD^2 = 7^2 + 5^2 - 2 \times 7 \times 5 \times \cos 120^\circ$$

$$BD^2 = 49 + 25 - 70 \times \left(-\frac{1}{2}\right)$$

$$BD^2 = 49 + 25 + 35$$

$$BD = \sqrt{130}$$

$$a = 130$$



Use the sine rule:

$$\frac{CD}{\sin 45^\circ} = \frac{\sqrt{130}}{\sin 60^\circ}$$

$$CD = \frac{\sqrt{130} \times \sin 45^\circ}{\sin 60^\circ}$$

$$CD = \frac{\sqrt{130} \times \frac{\sqrt{2}}{2}}{\frac{\sqrt{3}}{2}}$$

$$CD = \frac{\sqrt{130} \times \sqrt{2}}{\sqrt{3}}$$

$$CD = \sqrt{\frac{130 \times 2}{3}}$$

$$CD = \sqrt{\frac{260}{3}}$$

$$b = \frac{260}{3}$$