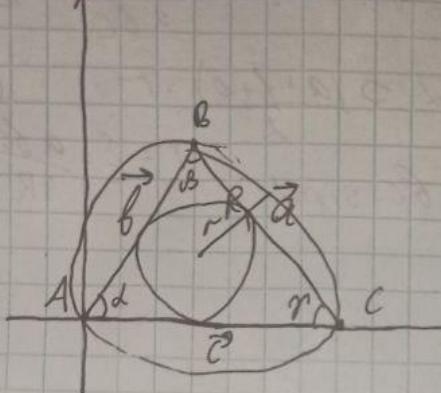


3.1.20



$$\begin{array}{l} \triangle ABC \\ \vec{BC} = \vec{\alpha}, \vec{AB} = \vec{b}, \vec{AC} = \vec{c} \end{array}$$

$$\vec{AB} = \vec{b} = b(\cos \beta + i \sin \beta)$$

$$\vec{AC} = \vec{c} = c(\cos \gamma + i \sin \gamma)$$

$$\begin{aligned} \vec{a} &= \vec{c} - \vec{b} = c(\cos \gamma + i \sin \gamma) - b(\cos \beta + i \sin \beta) = \\ &= (c \cos \gamma - b \cos \beta) + (c \sin \gamma - b \sin \beta) \end{aligned}$$

$$\begin{aligned} a^2 &= (c \cos \gamma - b \cos \beta)^2 + (c \sin \gamma - b \sin \beta)^2 = \\ &= c^2 \cos^2 \gamma - 2bc \cos \gamma \cdot \cos \beta + b^2 \cos^2 \beta + c^2 \sin^2 \gamma - \\ &\quad 2bc \sin \gamma \cdot \sin \beta + b^2 \sin^2 \beta = c^2(1 - \sin^2 \gamma) - 2bc \cos \gamma \cdot \\ &\quad \cos \beta + b^2(1 - \sin^2 \beta) + c^2 \sin^2 \gamma - 2bc \sin \gamma \cdot \sin \beta + \\ &\quad + b^2 \sin^2 \beta = c^2 - c^2 \sin^2 \gamma - 2bc \cos \gamma \cos \beta + b^2 - b^2 \sin^2 \beta = \\ &+ c^2 \sin^2 \gamma - 2bc \sin \gamma \sin \beta + b^2 \sin^2 \beta = b^2 + c^2 - 2bc (\cos \gamma \cos \beta + \end{aligned}$$

$$\begin{aligned} &\cos \beta - 2bc \sin \gamma \sin \beta = b^2 + c^2 - 2bc (\cos \gamma \cos \beta + \\ &+ \sin \gamma \sin \beta) = b^2 + c^2 - 2bc \cos(\gamma - \beta) = \end{aligned}$$

$$= b^2 + c^2 - 2bc \cos(\gamma - \beta) \Rightarrow \cos \gamma - \frac{(b^2 + c^2 - a^2)}{2bc}$$

JKL, $\sin \gamma = \sqrt{1 - \cos^2 \gamma} = \text{weg annehmen}$

$$\sin \alpha = \sqrt{1 - \left(\frac{b^2 + c^2 - a^2}{2bc} \right)^2} = \sqrt{\frac{(2bc)^2 - (b^2 + c^2 - a^2)^2}{4bc}}$$

$$S = p \cdot r = \frac{1}{2} \cdot b \cdot c \cdot \sin \alpha = \frac{(a+b+c)}{2} \cdot r$$

$$\sqrt{4bc(b^2 + c^2 - a^2)} = 2bc \cdot \sin \alpha \quad r = \frac{s}{p} = \frac{abc}{4R}$$