

Week 20: Problems

(Introduction to properties of triangles)

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1. Find R, a, c, C provided $\angle A = \frac{\pi}{12}, \angle B = \frac{\pi}{6}, b = 2$
 2. Estimate the distance between a pair of binary stars separated by an angle θ (not necessarily small) as viewed from earth. Assume that both stars are equidistant from earth with distance D . (This a very simplified version of the real situation. Hence, it need not reflect the reality.)

3. Prove that

$$\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{a+b+c} \iff \angle C = \frac{\pi}{3}$$

4. Find the relation between Δ (area of a triangle) and R (circumradius).
5. Prove that

$$\frac{\cot A + \cot B + \cot C}{\cot\left(\frac{A}{2}\right) + \cot\left(\frac{B}{2}\right) + \cot\left(\frac{C}{2}\right)} = \frac{a^2 + b^2 + c^2}{(a+b+c)^2}$$

6. Assuming $\angle B \neq \angle C$, prove that

$$\frac{\sin(B+C)}{\sin(B-C)} = \frac{a^2}{b^2 - c^2}$$