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Hours: MWF 11:20 – 12:20 MW 1:40 – 2:40

1. Show that in $\triangle ABC$ we have $\frac{1}{h_a}+\frac{1}{h_b}+\frac{1}{h_c}=\frac{1}{r}$.

*Solution:* If $K = A(ABC)$ then we have

$$\begin{aligned}\frac{1}{h_a}+\frac{1}{h_b}+\frac{1}{h_c} &= \frac{a}{2K}+\frac{b}{2K}+\frac{c}{2K}\\ &= \frac{s}{K}\\ &= \frac{1}{r}.\end{aligned}$$

2. Let $P$ be a point inside the regular $\triangle ABC$. Show that if $x$, $y$, $z$ are the distances of $P$ from $a$, $b$ and $c$ respectively then $x+y+z=h$ where $h$ is the height of the triangle.

*Solution:* We have

$$\begin{aligned}ah &= A(ABC)\\ &= A(ABP)+A(BCP)+A(CAP)\\ &= ax+ay+az\\ &= a(x+y+z)\end{aligned}$$

and so $h = x+y+z$.